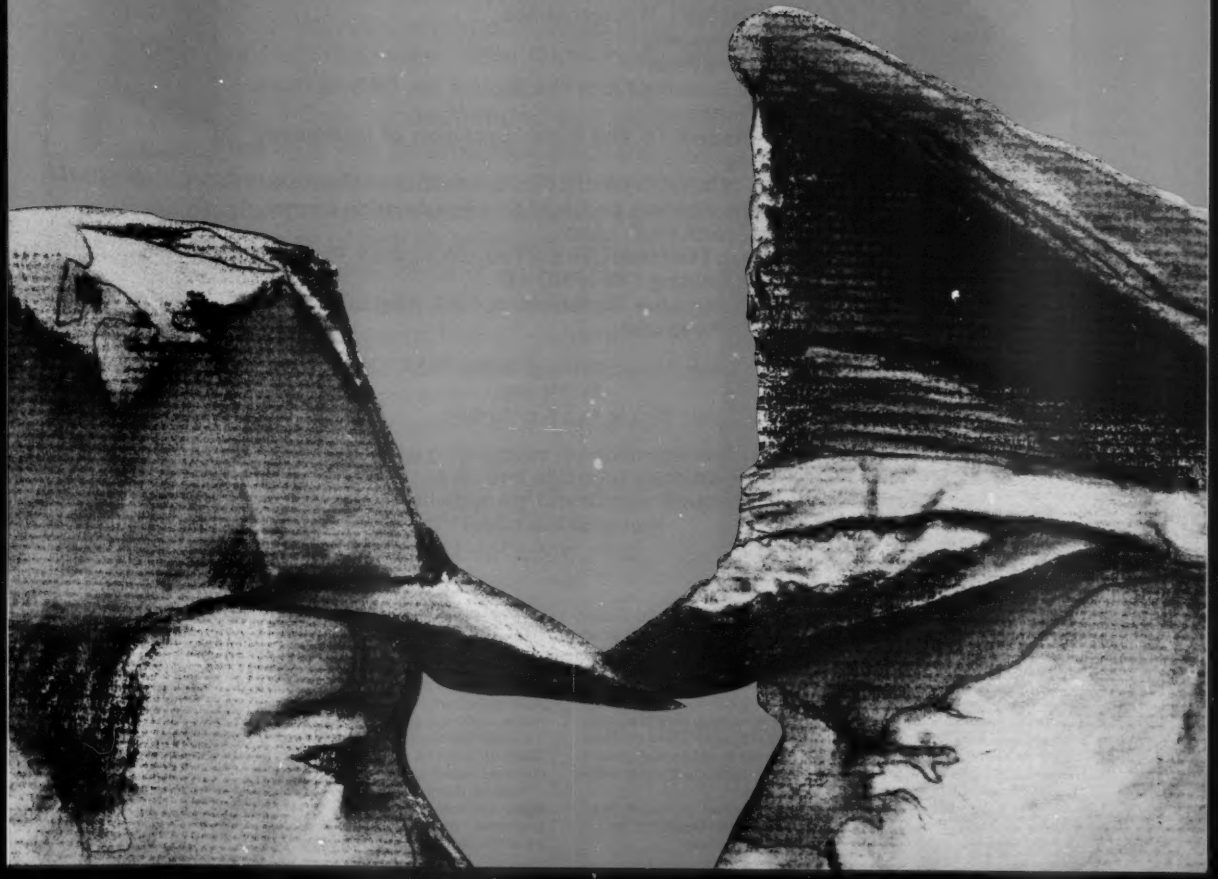
UNITED STATES ARMY

NOVEMBER 1980

AVIATION DIGEST



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page 2

page 14

2 **Aviation Personnel Management,** LTC Joe D. Carothers
5 **The Mohawk Came To The Mountain**
6 **The Aviation Commander—New Challenges During the 1980s,** LTC (P) E. H. Grayson Jr. and LTC J. W. Lloyd
10 **Demo Engine Program,** Roger R. Furgurson
12 **PEARL'S**
14 **SAM May Become An International Messenger,** Rush Wicker
16 **I Am Your Fuel Control,** Clarence J. Carter
20 **A Small Unit OPFOR Training Program,** MAJ Robert W. P. Patterson
22 **Recognition Quiz**
24 **The Flat Spin,** Wilburn James
24 **Spin Awareness**
29 **Reporting Final**
32 **Safety: Building From The Ground Up,** CW3 Rexford W. Swartz
34 **DES Report To The Field: Evolution of Instrument Flying**
38 **Down 'N Dirty,** Ronald R. Simmons and Joan Blackwell
41 **UH-60A Training At The U.S. Army Aviation Center,** CW2 Michael E. Little
44 **A Hole In The Head Can Kill You,** CW3 Lisle F. Pickard
45 **Threat: Beating The HIND—D**
48 **ATC Action Line: Violations of FAA Regulations By Army Personnel**

Inside Back Cover: **Annual Writ—1981,** CPT Kirk M. Knight

Back Cover: **TEC Is Not For Turkey**

Cover: **The acquisition of outstanding personnel for aviation, their retention and career development through purposeful management is the theme of this cover**

page 38

page 41

page 45

Richard K. Tierney
Editor

The mission of the ***U.S. Army Aviation Digest (USPS 415-350)*** is to provide information of an operational, functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine and other related data.

The ***Digest*** is an official Department of the Army periodical published monthly under the supervision of the Commanding General, U.S. Army Aviation Center. Views expressed herein are not necessarily those of the Department of the Army nor the U.S. Army Aviation Center. Photos are U.S. Army unless otherwise specified. Use of the masculine pronoun is intended to include both genders unless otherwise stated. Material may be reprinted provided credit is given to the ***Digest*** and to the author, unless otherwise indicated.

Articles, photos and items of interest on Army Aviation are invited. Direct communication is authorized to: Editor, ***U.S. Army Aviation Digest,*** P.O. Drawer P, Fort Rucker, AL 36362. Manuscripts returned upon request.

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THE STRENGTH, courage and vision which have brought Army Aviation from its modest beginning in 1942 to its present status as a member of the nation's defense team are rooted in its people and personnel program. So it is appropriate to offer many of them some inside information in the form of personnel related articles explaining further the provisions of OPMS Specialty Code 15 in this issue of the ***Army Aviation Digest.***

In "Aviation Personnel Management," Lieutenant Colonel Joe D. Carothers of MILPERCEN describes the commissioned officer career pattern currently being implemented as a result of the new aviation combat arms accession specialty, about changes being made to retain the valued aviation warrant officer, and about the positive recruiting measures being taken to attract outstanding and highly qualified enlisted men and women to Army Aviation.

One of the principal alterations affected by Specialty Code 15 is that many commissioned officers will enter aviation training directly from their basic course immediately following commissioning. They will then be assigned to aviation units as second lieutenants with principal duties in operational aviation assignments. Lieutenant Colonels E. H. Grayson Jr. and J. W. Lloyd explore the implications of that situation in "The Aviation Commander—New Challenges During the 1980s." This major change in the accession of aviators presents aviation unit commanders with new leadership, development and training requirements for their junior officers.

Providing the best for the Army Aviation team also includes keeping our fixed wing Army aviators informed on how to protect themselves in our inherently dangerous business. "Spin Awareness" and "The Flat Spin—Stay Away From It" are written to do just that. For those of you who know all about flying already, it is highly recommended as a worthwhile refresher.

At one time the spin was an integral part of the Army's flight training. However, the need for that maneuver has been largely negated by FAA guidelines on stall prevention and avoidance of ensuing spins, by alterations in the design and size of airfoils to lessen the possibility of spinning after stalling, and by the lack of aircraft certification for spins (IAW FAR Part 123). But the fact remains that all current fixed wing Army aircraft can still spin, and the failure to recover has caused many deaths. Therefore, the information contained in these two articles is valuable as a life-saving tool.

In all, you will find this November issue packed with well-written, informative articles for the aviation minded—so read on and enhance your professional knowledge—of a professional product.

Brigadier General Carl H. McNair Jr.
Commander, U.S. Army Aviation Center
Fort Rucker, AL

Aviation Personnel Management

Lieutenant Colonel Joe D. Carothers
Chief, Aviation Plans and Programs Branch
U.S. Army Military Personnel Center

Glossary—page 4

TWO YEARS AGO the Chief of Staff of the Army Directed formation of a study group to examine the personnel management of Army aviators. The findings and recommendations of the study group resulted in a revised commissioned aviator career pattern announced in April 1979, with these main provisions:

- Specialty Code 15 (Army Aviation) was designated a combat arms specialty.
- Specialty Code 15 joined SC 71 (Aviation Materiel Management) as an accession or entry specialty selected before commissioning.
- Commissioned officers entering Army Aviation assigned to "carrier"

branches (Infantry, Armor, Field Artillery, Air Defense, Military Intelligence or Signal Corps) attend basic and advanced courses of the carrier branch, and will be assigned and developed as combat arms aviators. Commissioned aviators holding SC 71 will be assigned to Transportation Corps. (Medical Service Corps aviators with additional skill identifier 67J will continue to be managed by the Office of the Surgeon General.)

Approval of the study group recommendations marked the beginning of a comprehensive program to meet Army Aviation requirements and fulfill individual career aspirations. Personnel managers recognized the need for deliberate and coordinated implementation efforts. This year a follow on task force completed a review of the manning documents and verified the current and projected positions requiring aviators by grade, specialty or MOS and category (operational or nonoperational). As requirements were matched against current and projected assets, the documentation of a serious warrant officer retention problem not evident during the original study became apparent and required a realignment of implementation priorities. Additionally, policy changes addressing Armywide company grade shortages (not limited to aviators) produced the current selective continuation program for officers not selected for promotion. All of these developments will require continuous coordination and updating as they evolve.

With implementation of the commissioned officer career pattern well on its way, a number of actions and programs at MILPERCEN deserve comment. For the first time, commissioned accessions included SC 15 as the FY 1980 accession plan was developed to appoint cadets of the United States Military Academy and Reserve Officer Training Corps college graduates into appropriate branches with Specialty 15. Highly qualified men and women from these programs and officer candidate school, as well as officers already on active duty, filled all available flight training quotas.

Commissioned aviators fared well in 1980 selection rates for temporary promotion to major, lieutenant colonel and colonel as well as in selection for command and general staff and senior service college level schooling. The 1980 selection rates for promotion to temporary major (first time considered) were 80 percent for SC 15, 85 percent for SC 71 and 74.9 percent for the overall Army promotion list.

Under OPMS, professional development of aviators parallels that of other officers. At their eighth year, aviators receive a second specialty based on their experience, education, interests and Army requirements. Figure 1 shows specialty combinations of aviators in year groups 72 and 73.

Much of what is discussed here is reflected in the ongoing reorganization of the Officer Personnel Management Directorate. As noted earlier in OPMS Corner articles in the ***Aviation Digest*** Majors Division merged with Combat Arms, Combat Support Arms and Combat Service Support Arms Division in August 1980. By February 1981, Lieutenant Colonels Division will also join those divisions. Colonels and Warrant Officer Divisions will remain in their current structure.

Nearly half of all warrant officers managed by MILPERCEN are rated aviators. Warrant officer aviators are trained specifically to pilot Army aircraft, instruct new and experienced aviators, manage aviation safety programs and perform supervision of aircraft maintenance. Retention of warrant officer aviators beyond initial service obligation following flight training is a serious concern at this time.

Warrant Officer Division has initiated a number of actions to identify the critical issues and examine solutions. Actions to date include letters to MACOM commanders, which produced significant feedback such as concern for grading of warrant officer positions; repeat study of grades W5 and W6; direct commission proposals; and attempts to equalize aviation career incentive pay between commissioned and warrant officers. A much more comprehensive effort is being coordinated by MILPERCEN and includes representatives from the U.S. Army Aviation Center and the U.S. Army Research Institute Field Unit, Ft. Rucker, AL to identify satisfiers and dissatisfiers that affect retention. To assist ARI in its efforts, a group of warrant officer students attending the Warrant Officer Career College volunteered to examine career tracking, grading, direct commissioning, formal training versus experience gained in additional duties, and pay and benefits. An IPR presented at Ft. Rucker in September 1980 identified five major areas in need of further analysis and resolution. These include:

- Equalization of pay (both ACIP and base pay).
- Interservice involvement and legislative problems affecting W5 and W6 grades and grading of positions.
- Single versus multitrack career patterns (such as air traffic control, medical evacuation, supply, motor maintenance and administration).
- Actions that must be taken to change current minimum federal commissioned service restrictions to qualify for participation for possible direct commissioning programs.
- Identification by ASI of warrant officer senior course graduates.

Worldwide collection of survey data from commands and personnel throughout the Army is scheduled for completion by November 1980, with a final report submitted to MILPERCEN no later than 30 March 1981.

The Army supports the equalization of aviation career incentive pay for commissioned and warrant officer aviators. Much is yet to be done within Department of Defense and Congress to make it happen. The recent ACIP increase resulting from the Nunn-Warner Amendment, contained in figure 2, is a step in the

FIGURE 1:

SPECIALTY COMBINATIONS HELD BY AVIATORS IN YEAR GROUPS 72 AND 73

SPECIALTY CODE	21	25	27	28	31	35	36	37	41	42	43	44	45	46	48	49	51	52	53	54	72	74	75	81	87	91	92	95	97
15	15	7	3	7	8	19	5	8	30	8	1	1	9	11	14	26	28	5	20	49	0	5	3	1	1	10	26	11	10
71	4	0	0	0	0	0	1	0	11	3	0	0	3	3	4	3	18	0	5	11	1	0	0	0	0	11	17	10	7

right direction.

Other actions have been underway to ensure sufficient numbers of best qualified Soldiers are selected to attend flight training. The past year saw the introduction of the revised FAST, which is expected to provide a more accurate prediction of success in flight training.

Also, the number of quotas available to inservice enlisted Soldiers was increased, and procedures were developed for a small number of highly qualified people from the Navy, Air Force, Marines and Coast Guard to request interservice transfer to attend aviation warrant officer training. Positive recruiting initiatives have been taken to attract and select additional females and minority service members for aviation training. The management of enlisted aviation personnel to meet Army requirements is the key to success on the battlefield. At present CMF 67 reflects an undesirable structure characterized by quick promotions at the bottom, immigration from other fields at the center and constrained promotion opportunity at the top. The Office of the Deputy Chief of Staff for Logistics recently concluded indepth study of CMF 67. Results are under review. Future issues of the ***Aviation Digest*** will contain updates as more information becomes available.

The mission of Army Aviation is to extend the capability of the Army to conduct prompt and sustained combat operations on land. We must continue to develop those programs necessary to acquire and manage the combat aviators and Soldiers who must fight the first battle of the next war.

GLOSSARY

ACIP	aviation career incentive pay
ARI	Army Research Institute
ASI	additional skill identifier
CMF	career management field
FAST	flight aptitude selection test
FY	fiscal year
IPR	in-progress review
MACOM	major Army command
MILPERCEN	Military Personnel Center
MOS	military occupational specialty
OPMS	Officer Personnel Management System
SC	specialty code

FIGURE 2: NUNN-WARNER ACIP RATES

YEARS SERVICE	COMMISSIONED OFFICERS	WARRANT OFFICERS
2 or less	$125.00	$125.00
Over 2	156.00	138.00
Over 3	188.00	
Over 4	206.00	
Over 6	306.00	250.00
Over 18	281.00	
Over 20	256.00	
Over 22	231.00	
Over 24	206.00	
25	0	

WHEN WASHINGTON'S Mount St. Helens erupted 18 May, the Grumman OV-1 Mohawk surveillance aircraft belonging to the Oregon Army National Guard provided a means for scientists to study and record the explosions. Captain Steve Hammons, left, and another Guard pilot gather data, using the Mohawk's infrared or side looking airborne radar sensors. That equipment permitted the imagery penetration of the cloud and volcanic dust cover over the crater (below). Photographs by Gerry Costello, Grumman Aerospace Corp.

THE MOHAWK CAME TO THE MOUNTAIN

the AVIATION COMMANDER

Lieutenant Colonel (P) E. H. Grayson Jr.
and
Lieutenant Colonel J. W. Lloyd*

Training Directorate (Aviation)
Office of Deputy Chief of Staff for Operations and Training
Headquarters, Department of the Army
Washington, DC

*LTC Lloyd is now a student at the National War College, Carlisle Barracks, PA

New Challenges During

AVIATION COMMANDERS at all levels will soon begin facing an exciting and new challenge. During the 1980s a "new breed" of commissioned officer aviators will join the ranks, and present-day commanders, unlike their counterparts from the past, will be faced with giving these new aviators "officer training."

As a result of recent Specialty Code (SC) 15 decisions, 85 percent of our aviation accessions will now attend flight school immediately upon completion of an officers' basic course. Let's think about this and examine the impact of that innovation upon the aviator commander.

In the past, almost every commissioned officer aviator spent from 2 to 5 years on "ground duty" prior to attending flight training. Complementing this was the other group of officers who possibly spent 2 to 5 years in various ground assignments prior to joining an aviation unit. Most, if not all, of these officers had served in responsible positions, including duty as platoon leaders. In fact, some of these officers had been company, troop or battery commanders. It was not at all unusual for the majority of aviation units to have experienced former company level commanders in each aviation platoon. Consequently, when these new aviators were assigned to aviation battalions, there was simultaneously a wealth of command and leadership experience arriving at the same time. Lessons learned during a myriad of ground duty assignments were easily transferable to the requirements of a first aviation assignment. ***Leadership*** is ***leadership***, and although the aviation environment presents unique challenges the basic troop-leading procedures are the same.

In the "old days" senior lieutenants and junior captains joined aviation units as section or even platoon

MONTHLY WRITING AWARD

the 1980s

The masculine pronouns as used in this article represent both the masculine and feminine genders unless otherwise stated

commanders. The leadership requirements of their job presented few problems and those "fledgling" pilots could concentrate upon perfecting their flying skills. Commanders were not required to spend much, if any, time in "officer" training, other than those command-related responsibilities associated with leadership development.

When the name of the new lieutenant or captain came up on the battalion duty roster, there was no major requirement to meticulously go over his responsibilities—he had been an officer of the day in prior assignments! Maybe he had never checked the security of an airfield, but he had certainly gained expertise in checking motor pool security, could run a guard mount, inspect an arms room or a dining facility and was very familiar with barracks security problems. That lieutenant or captain in the old days could handle the requirements of additional duties. He grew up in a company, troop or battery with about six other officers who split the numerous additional duties. So, when he joined an aviation unit with 35 to 40 officers and warrant officers handling the same number of additional duties, the fact that he was assigned as the unit nuclear-biological-chemical (NBC) officer really didn't present an insurmountable challenge. That lieutenant or captain could run a rifle range, handle a report of survey, counsel and provide Soldier leadership and generally discharge the duties and responsibilities of his grade and job description.

It was a great system and it may have spoiled us. We will soon know because we are entering a brand new era!

Let's take a close look at the "senior grade" lieutenant aviators who will be walking into your orderly room or battalion headquarters from now on. They are going to be second lieutenants. Now there is a novelty

in itself! Just a few months ago a second lieutenant aviator was indeed a rare bird. Now they are about to become the rule.

Where is this new aviator coming from when he signs into your unit? Reserve Officers' Training Corps (ROTC)? U.S. Military Academy (USMA) at West Point? Officer Candidate School (OCS)?—and by way of a basic course and flight school. What will he know? That's a tough question, so let's speculate a bit. Depending upon the nature of their Professors of Military Science, ROTC graduates may be thoroughly up-to-date in military history, tactics, management theory and leadership or a combination of those and other subject areas contained in the flexible programs on the various college campuses. Most will have the relatively common background of summer camp including several leadership positions of varying importance. OCS graduates will bring extensive leadership development experience with them gained from a concentrated officer development program where assignment in the various command positions was a daily and demanding experience. The West Point arrival will bring a combination of the others and will also include a previous summer tour with an active unit, thus gaining invaluable experience prior to commissioning. Obviously there will be a significant variance among the ROTC, USMA and OCS lieutenants which even further compounds the problem of trying to determine "what" our new aviators will know based upon their previous education and training.

Although the future commissioned officer aviators will be accessed in SC 15, they will, at least for the foreseeable future, be "branched" in one of the combat arms, to include Military Intelligence or Signal Corps. While there is some commonality within basic course curriculums, there also is a wide disparity in aviation-related programs among the branch schools. It is not difficult to visualize what individual branch schools orient toward simply by a brief examination of their respective missions. However, there is little if any basic course instruction geared toward the numerous additional duties lieutenants are assigned, and nowhere in the branch programs of instruction are future aviators taught how to be aviation section or platoon commanders.

So, out of the basic courses come young officers trained to move into platoon leader positions or other appropriate jobs in the Infantry, Armor, Field Artillery, Military Intelligence and Signal branches. Keep in mind, Mr. Aviator Commander, that there is no basic course in the business designed to produce *aviation* junior leaders! Thus, we can surmise that for the most part we will be unable to generalize in regard to "what" the junior officer will bring with him as a result of the basic course experience. In plain words, the aviation commander now is charged with leadership development and training of the newly assigned aviator.

The single common education and training experience that the future commissioned officer aviator will share is flight school. What do aviators learn at the U.S. Army Aviation Center, Ft. Rucker, AL? They learn to F-L-Y, and the flight training program is better today than any time in history. In addition to becoming a highly skilled aviator, the lieutenant will concentrate on tactics (aviation), maintenance, safety and other topics relating to aviation. Unless there has been a recent change to the Aviation Center program of instruction, there is no "officer" training, no leadership training and no additional duty training.

"Get the picture, Aviation Commander?" Into your orderly room or headquarters walks a second lieutenant SC 15 aviator—a product of West Point, ROTC or OCS. He has been through one of the basic courses and has attained the basic aviator qualification through graduation from flight school. That lieutenant is far different from the new aviator officer you have had assigned in past years. Now, *you* have a training challenge and *you* have the challenge to exercise all the leadership qualities gained as a result of your Army experience in getting your new arrival off to the right start. *Your* requirements and potential solutions are too voluminous for this article; however, let's examine a few of the challenges.

It is recognized that aviation commanders at all levels must develop a full understanding of tactics two echelons above those normally understood by their ground contemporaries. For example, a combat arms lieutenant must develop a firm grasp of company or troop tactics; however, the new aviator lieutenant

supporting tactical units must understand the principles of fire and maneuver up to and including brigade size forces. It's apparent that if the aviator lieutenant is to provide firepower, mobility, reconnaissance, command and control and logistical support for the brigade, then it is essential to understand how the brigade operates. Who is going to teach brigade tactics? *You* are, aviation commander!

How are you going to accomplish this new mission (in addition to the myriad of other assigned tasks)? Through frequent officer classes, on-the-job training during field exercises (that one may not be timely enough), use of liaison officers? The point is—*you* must train your new commissioned aviators in order to ensure that they can accomplish *your* mission! You might even consider the feasibility of short exchange tours with the infantry, mechanized or armor battalions in the division to allow the lieutenants to quickly gain an appreciation for the difficult roles and missions of the ground combat units. Would a short period in an infantry company, battalion or on a brigade staff help? Could an exchange of this type reinforce and enhance the tactical instruction *your* aviators received at the branch basic course? Think it over!

The new second lieutenant reports to you and you will assign him as a section leader, or maybe even a platoon leader if your unit is under the Division 86 table of organization and equipment. Who is going to teach your lieutenant what being an officer is all about? Who is going to help him distinguish between looking out for the welfare of the Soldiers and coddling them? *You* are, aviation commander! How will you do this in addition to the countless other command responsibilities you are already saddled with? The solutions are only limited by your imagination and experience. Did you have a good combat arms platoon sergeant to get you started off on the right track? Can you turn your new second lieutenant over to one of your platoon sergeants for training? Tread carefully—look at his background—has he come up through the mechanic, crewchief, technical inspector route? If so, he may not be the best available leadership instructor or counselor. *You* may be the best available. However, don't overlook the wealth of talent and experience of your assigned warrant officers! You may have warrant officers that have filled battle captain positions and can take your new lieutenant "in-tow" and provide him with invaluable "on the job" tactical training.

Let's continue with the scenario while *you* prepare the additional duty assignments. If you assign your second lieutenant the NBC and physical security job, will he know the requirements of the job? Not likely! Will you consider your new lieutenant for the motor officer's job? Not likely! *You* must provide the guidance and instruction, and *you* now must exert your leadership ability in an arena where previously it was required to a lesser degree. Again, use the talent of your warrant officers at every opportunity.

"The times-are-a-changing" as the song goes. Nowhere are things changing more rapidly than in Army Aviation training. We are in the midst of perfecting flight techniques that will allow aviation to survive on the modern battlefield. New aircraft are joining the inventory and others are just down the road! Division 86 and the air cavalry attack brigade (ACAB) testing is imminent. Night Hawk training is moving in the right direction; the night vision goggle program has started to move; inroads have been made in the tactical instrument training arena. "Things are happening," and this is an exciting time to be involved with Army Aviation.

With all of this going, it might be easy to overlook the necessity to train and develop our young commissioned aviators. Don't overlook *that* mission because your second lieutenant aviator is tomorrow's ACAB commander!

How *you* train the young commissioned aviators will significantly determine the future of Army Aviation.

DEMO ENGINE PROGRAM

How does an engine with significantly better fuel consumption find its way into a new Army aircraft?

Roger R. Furgurson

U.S. Army Research and Technology Laboratories
Fort Eustis, VA

THE APPLIED Technology Laboratory (ATL), U.S. Army Research and Technology Laboratories (AVRADCOM), Ft. Eustis, VA, has announced the achievement of one of the most significant goals in its 800-Horsepower Advanced Technology Demonstrator Engine (ATDE) program. During recent engine testing the fuel consumption characteristics of the ATDE were determined to be more favorable than the established goal.

This means that the ATDE has lower fuel consumption (the amount of fuel burned per hour for each horsepower being developed) than any other known turboshaft engine in the world under 1,000 horsepower.

Fuel consumption can trigger a conversation in any group at any time. Since the oil embargo in 1974 and particularly since the gas lines of 1979 and the $1.25 and up per gallon prices of 1980, everyone is tuned in to the need to conserve energy. Engineers and others dealing with the design of most combat vehicles always have been concerned about fuel consumption, but sensitivity to this aspect of performance is greatest in aircraft design.

A combat helicopter can carry more payload or operate over a wider mission radius if it is equipped with more efficient engines. In addition to the obvious operational improvements that are brought about by lower fuel consumption, very significant life cycle cost benefits are realized because of the high cost of fuel. *But how does an engine with significantly better fuel consumption find its way into a new Army aircraft?*

Turbine engines historically have required considerably more development time than the aircraft which they power. Unless the engine development is started earlier than the aircraft development program, the two schedules will not be compatible. This has frequently presented a problem for upper echelon defense department managers; the difficulty of obtaining approval for a high level of funding for engine development *prior to* the complete aircraft system having been approved. The concept of a demonstrator program was conceived to fill this gap. For a fraction of the cost of full-scale development, the demonstrator program can determine the potential level of performance for a particular engine configuration.

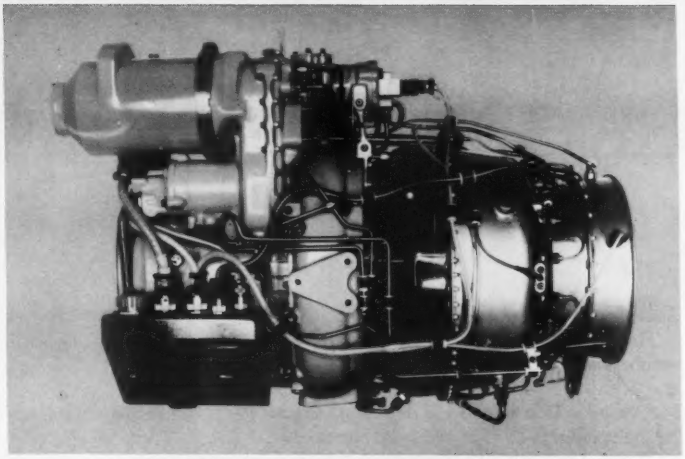
Since more than one developer participates in the demonstrator phase, some options exist prior to commitment to full-scale development. However, if the demonstrator phase is to produce truly meaningful results, it must encompass all known requirements of an Army helicopter engine. Due to the very nature of helicopter operations, engines are required to cope with a severe environment. Landings are routinely made in unprepared areas, creating a large quantity of flying dust, leaves, sticks, hay, grass or any other material that may become airborne when whipped by the hurricane-force winds of the rotor's downwash. An inlet protection system must be provided to protect the engine from this debris. The demonstrator engine incorporates this system in its basic design so

that the recorded performance includes any losses associated with the protective system.

Army helicopters at times must be maintained under adverse conditions with a minimum of people, tools and equipment. The engine design engineers must consider the method of disassembly, location of removable items, available access to bolts, screws, etc. Sometimes these considerations adversely impact performance and trade-offs have to be made.

In spite of these many considerations, the eventual cost of producing an engine must be reasonable. Many factors affect engine production cost—such as type of materials, method of fabrication and the basic component design. Some of these, in turn, affect performance. All of these factors are considered during the demonstrator program so that the performance attained is realistic. When the complete aircraft system development nears completion and detailed planning is initiated, the aircraft systems manager has available realistic engine performance and cost information. The subsequent full-scale engineering development will be at less risk and the engine and aircraft schedules will be compatible.

Planning for the 800-Horsepower ATDE program began early in 1975.



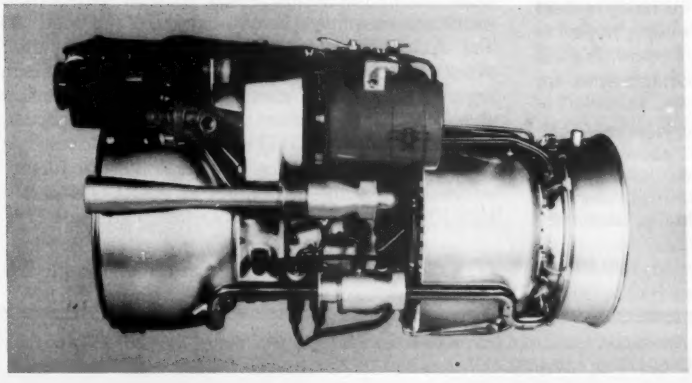
Detroit Diesel Allison ATDE Mockup

Its content and structure were based upon the Army's previous 1,500-Horsepower Demonstrator Engine program. This earlier demonstrator program provided the technical foundation for the T700 engine which now powers the UH-60 Black Hawk and AH-64 advanced attack helicopter.

The ATDE program consists of two separate efforts being undertaken by AVCO Lycoming and Detroit Diesel Allison. About 500 hours of engine testing will be accomplished by each contractor, which will include environmental tests to determine the effects of sand and dust, low temperature operation and temperature distortion at the engine's inlet.

Performance determination and durability testing also will be conducted. At the end of June 1980 about half of the testing had been completed. It was during this testing that the fuel consumption characteristics were determined to be better than the original program goal. Although testing to date has to be considered preliminary, it does show that the aerothermodynamic efficiency of the components is close to the design goal. Further development is expected to result in an even greater improvement of the performance already attained.

AVCO Lycoming ATDE Mockup



About the Author:

Roger G. Furgurson has been with the Applied Technology Laboratory, AVRADCOM, Ft. Eustis, VA, since 1965. He is now one of the two project engineers for the Advanced Technology Demonstrator Engine program. Mr. Furgurson received a B.S. degree in mechanical engineering from Virginia Polytechnic Institute in 1959.

PEARL'S

Personal Equipment And Rescue/survival Lowdown

Telephone Numbers

There has been a minor change in the telephone numbers assigned to the U.S. Army Materiel Development and Readiness Command (DARCOM) Project Office for Aviation Life Support Equipment. Extension 3721 has been eliminated. The office can be called at AUTOVON 693-3307/3308 or Commercial 314-263-3307/3308.

Accolades Are In Order

We would like to take this opportunity to thank all of you commanders, aviators and other aircrewmembers who provided us with excellent data in the questionnaires which were returned as part of the system assessment of aviation life support equipment (ALSE). The information you provided resulted in about a 75 page analysis of the overall ALSE system and identified or accentuated problem areas that we will work to correct. Again, thanks for your support. You can be assured that the time you devoted to filling out your questionnaires was time well spent and we will see the benefits. One thing is for sure—the system assessment has made many people aware of the critical need for ALSE.

A.B.C. DAVIS JR.
DARCOM Project Officer
Aviation Life Support System

Get Well Dates

In addition to those we have told you about individually, stocks of certain other ALSE items are currently in short supply or completely exhausted. Those items, as well as the anticipated get well dates, are listed below. We will try to keep you informed of all such shortages as we are made aware of them.

Panel Marker, Survival	8345-00-140-4232	November 1980
Ear Pad Assy (SPH-4)	8415-00-143-8577	November 1980
Spacer, Tapered (SPH-4)	8415-00-410-4665	January 1981
Clipboard, Lighted	8465-00-433-2073	June 1981
Clipboard, Unlighted	8465-00-082-2636	June 1981

Oxygen System Lubricants

Hydrocarbons introduced into oxygen systems can cause disastrous effects. Oxygen systems are receiving a great deal of scrutiny these days—this is all part of an effort to keep lubricants which are not compatible with oxygen away from oxygen systems. Right now the only four lubricants approved for use on oxygen systems are:

Halocarbon 25-5S	9150-00-754-2760
MIL-G-27617, Type I Krytox 240AZ	9150-00-007-4384
MIL-G-27617, Type II Krytox 240AB	9150-01-008-0498
MIL-G-27617, Type II Krytox 240AC	9150-00-961-8995

USAF Technical Order 15X-1-1, Oxygen Equipment, has been supplemented to include this information.

Hold On To Yours!

No matter what the date on your signal kit, foliage penetrating (L119), national stock number (NSN) 1370-00-490-7362, do *not* dispose of it! There has been a critical shortage of this particular component of the SRU-21/P survival vest, and many of those signal kits currently in the field have long since surpassed their shelf and/or service life. Well, it seems that the U.S. Army Armament Materiel Readiness Command (ARRCOM) has found a way to solve part of the problem—they have simply extended the shelf life and service life of this item from 6 years to "indefinite." What this means is that all L119 kits in the field, regardless of date of manufacture, are now serviceable. This information is contained in a message issued by HQ ARRCOM, DTG 171440Z Sep 80, subject: Ammunition Information Notice 57-80. For further information, point of contact at ARRCOM is Mr. John Rutledge, AUTOVON 793-4851, extension 219.

If you have a question about personal equipment or rescue/survival gear, write PEARL, DARCOM, ATTN: DRCPO-ALSE, 4300 Goodfellow Blvd., St. Louis, MO 63120 or call AUTOVON 693-3307 or Commercial 314-263-3307

New NSN For Coveralls

Coveralls, flyer's, men's lightweight aramid, fire resistant, NSN 8415-00-491-0898(S), LIN F32055, are being replaced by NSN 8415-01-043-8376(S). However, requisitioners are requested to continue ordering under the old NSN even though the Army Master Data File shows this item to be a phase-out item. As stocks of the replaced item become exhausted, requisitioners automatically will be supplied with the new item. Requisitioners should be sure not to use advice code "2B" (do not substitute).

Body Armor

End item assets of the assembled body armor, small arms protective, LIN B85126, have been exhausted in the regular size, NSN 8470-00-935-3193. Also, only minimal assets are available for the short size, NSN 8470-00-935-3192. No additional procurements of these items will be made. However, requisitioners can still obtain these sizes by ordering the individual components and assembling the end items. Listed below are the components required for each size in question, as well as their respective NSNs.

Size	Vest	Front Plate	Back Plate
Small	8470-00-999-1473	8470-00-935-3177	8470-00-935-3174
Regular	8470-00-999-1474	8470-00-935-3178	8470-00-935-3175

Questions And Answers

We are having a minor problem in our flight facility with certain aviators who simply refuse to conform and wear standard Army-issue flight gear. We even have one individual (a Department of the Army Civilian (DAC), at that) who refuses to wear an olive drab SPH-4 flight helmet. This individual insists on wearing an SPH-4 that he has had painted bright red, based solely on the fact that he does not like OD! What can we do about people like that; what regulation or other publication prescribes specifically what the aviator should be wearing?

(Captain F. L.)

It is difficult to believe that there are people in the Army Aviation community with attitudes such as you describe! You would especially think that a DAC would want to set the proper example for those U.S. Army Reserve aviators that he works with. At any rate, there *are* specific regulations which prescribe the proper clothing and equipment to be used by Army Aviation personnel, and these regulations pertain to DACs as well when flying Army aircraft. Section IV to Chapter 3 of AR 95-1 tells you what the specific requirements are for ALSE, to include an "approved flight helmet." (In this particular case, the only flight helmet approved for the Army is either NSN 8415-00-144-4981 or NSN 8415-00-144-4985, helmet, flyer's, SPH-4, fiberglass, olive green, Army shade 106. In addition, TM 10-8415-206-13 for the SPH-4 specifies by NSN the paint to be used on the helmet, and the color prescribed certainly is *not* red!) All of the required ALSE is authorized via CTA 50-900, with the exception of the survival radio, which is a table of organization and equipment/tables of distribution and allowances item.

SAM May Become An International Messenger

A means of communication between aircrews when the use of radios would lead to detection of their aircraft by the enemy is a vital necessity for the armies of the United States and its NATO allies. The author discusses a proposed way to fill that need.

Rush Wicker
Directorate of Combat Developments
U.S. Army Aviation Center
Fort Rucker, AL

THE TASK OF PROVIDING an international standardization agreement (STANAG) for a nonelectronic communication device was given to the U.S. Army's delegation at the 4th Helicopter Interservice Working Party (HISWP) held at the U.S. Army Aviation Center, Ft. Rucker, AL, last March. In compliance with that responsibility, the SAM (Send-A-Message) system has been submitted for adoption by the NATO armies. The draft STANAG will be voted on next March at the HISWP in Belgium.

SAM was developed by Captain James MacSwords and Captain William Soneira when they were assigned to the 101st Airborne Division (Air Assault), Ft. Campbell, KY, and it was described in an ***Aviation Digest*** *article in July 1978. (Copies of the article are available from the Editor,* ***Aviation Digest****, P.O. Drawer P, Ft. Rucker, AL 36362.)*

The system also is explained in the following speech which was presented by the author at the 1979 HISWP:

Generally speaking, nations of the world have not given the attention that should be given to radio security. This may have resulted from the fact that opposing forces have not possessed a radio intercept capability or that they lacked the capability to react to the information gained in time to be an influence on the course of action. This attitude toward radio security can no longer be tolerated.

Technological advances in radio intercept and position finding equipment could enable a threat nation to intercept and locate the transmitting station as the message is being sent. As the coordinates of the station are being read, the fire direction center would be computing ballistic data to be transmitted to the guns.

In addition to the capability of radio direction finding, the enemy possesses the capability to jam most electronic transmissions. The enemy electronic countermeasures capability does not always make you aware that your electronic transmissions are being monitored. The insignificant message you send may not provide the enemy any information by itself, but it may be all that is needed when put together with other bits of information to give the enemy vital data.

To ensure the success of a mission, the enemy must be denied information that will help to destroy you. Secure radio provides a means of denying the enemy knowledge of what is being transmitted; however, the direction finding capability is not denied. With this in mind, a nonelectronic communication system has been developed which provides a means of short-range, air-to-air communication. This same system is also adaptable for air-to-ground, ground-to-air or ground-to-ground communication.

The system is referred to as "SAM," which is an acronym for SEND-A-MESSAGE. It consists of two sets of five colored cards mounted to a solid backboard. Each card is a different color, with a contrasting numeral printed on the card. The numbers and colors reinforce each other when vision is degraded by visibility restrictions and distance. Using this system 36 messages can be transmitted. A code system is also provided whereby a series of dots and dashes are used in lieu of numbers or color combinations.

A light device for transmitting dots and dashes would be used during periods of darkness.

The SAM system was tested in the air-to-air and ground-to-air role at distances of 25 to 250 meters. All of the colors and numbers were recognizable with 100 percent

accuracy at ranges up to 150 meters; moreover, even greater range capability was achieved with most colors and numbers. As crewmembers became more familiar with the system, messages could be decoded as rapidly as they could be sent.

During the development of key words for the definition sheet, specific categories were grouped together. For example, 1-1 through 1-6 relates to instruction; 2-1 through 2-6 relates to infantry; 3-1 through 3-6 relates to armor; 4-1 through 4-6 relates to danger or threat; 5-1 through 6-6 relates to description and location (see accompanying figure at right).

In order that you may appreciate the simplicity of the SAM system, let's develop a message. Assume that the pilot of a scout helicopter needs to send a message to the aircrew of an attack helicopter in the holding area. The scout pilot wants to advise the attack helicopter team leader that an enemy tank company has been located and that he will lead the attack helicopters to the attack position. The following message would be sent:

33—25—36 (tanks—company—follow me—attack position).

Assume now you are the receiver and a message is being transmitted to you. If you cannot interpret as quickly as the message is transmitted, copy the numbers and complete the translation at your own speed.

45—15—34—12—26 (cease fire—return—refuel—move—holding area).

In preparing the message you may have noticed a need for additional key words. The SAM system allows you to supplement the standardized basic definition sheet with a spare list of key words. By transmitting 66 in the message, the person receiving the message knows to use the spare definition sheet to decode the message. Thirty-six key words can be added for each spare definition sheet. Each subordinate unit may have a spare which is peculiar to its operation. When a unit uses more than one spare definition sheet, each spare must have a code identification to ensure the same sheet is being used by the sender and receiver.

The SAM system of nonelectronic communication has proven to be a reliable means of air-to-air communications. It is not intended to replace our radios but to provide an alternate means of communications when radio use is denied or when it is important that the enemy not detect our position.

U.S. Army units are encouraged to incorporate the SAM system as part of their communication security training. The SAM device can be obtained from:

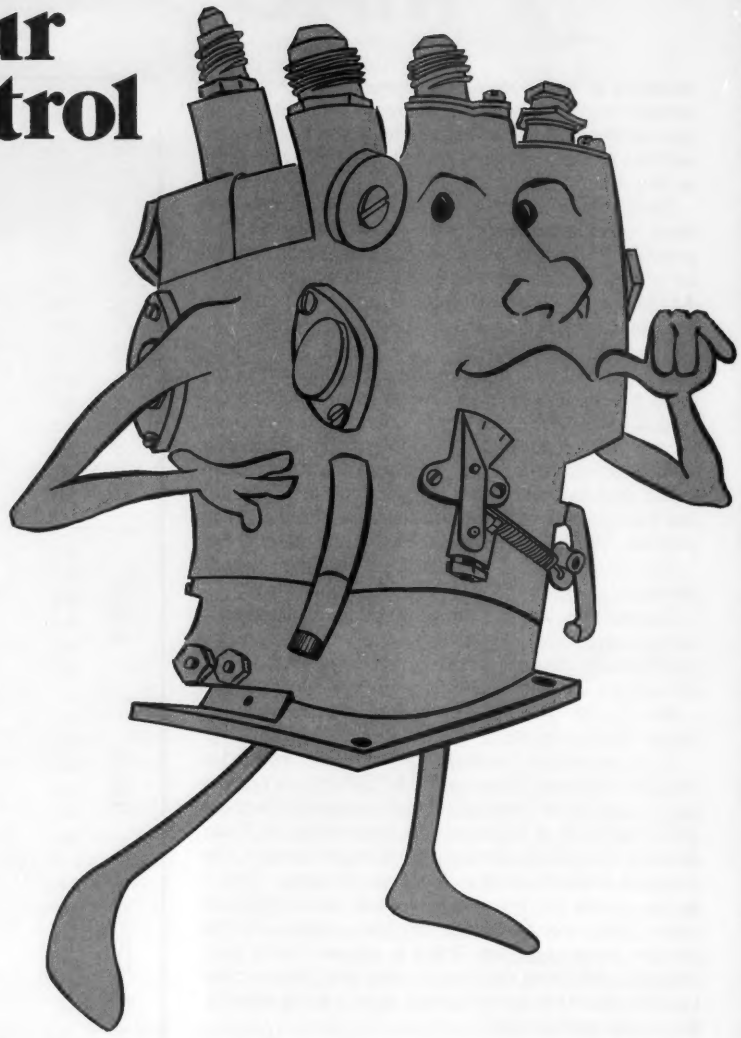
Commander
U.S. Army Aviation Center
ATTN: ATZQ-TD-TASC
Ft. Rucker, AL 36362

DEFINITION SHEET

	CODE	LETTER	NO	MESSAGE
INSTRUCTION	1-1	A	1	AZIMUTH
	1-2	B	2	move, -ing
	1-3	C	3	check point
	1-4	D	4	DISTANCE
	1-5	E	5	return
	1-6	F	6	follow me
INFANTRY	2-1	G	7	GRID
	2-2	H	8	troops
	2-3	I	9	squad
	2-4	J	10	platoon
	2-5	K	11	company
	2-6	L	12	holding position
ARMOR	3-1	M	13	attack helicopters
	3-2	N	14	BMP/APCs
	3-3	O	15	tanks
	3-4	P	16	POL/refuel
	3-5	Q	17	HQ/CP
	3-6	R	18	attack position
THREAT	4-1	S	19	aircraft
	4-2	T	20	GAS/CBR
	4-3	U	21	artillery
	4-4	V	22	DANGER
	4-5	W	23	Cease fire
	4-6	X	24	Mine(s), -ed
DESCRIPTION AND LOCATION	5-1	Y	25	on the road
	5-2	Z	26	camouflaged
	5-3	AA	27	stationary
	5-4	BB	28	FIRE -,
	5-5	CC	29	ALL CLEAR
	5-6	DD	30	friendly
	6-1	EE	31	bridge/ford
	6-2	FF	32	LZ/PZ
	6-3	GG	33	I SPELL
	6-4	HH	34	recon
	6-5	II	35	need medevac
	6-6	JJ	36	SPARE

AZIMUTH to nearest 10 degrees. DISTANCE to nearest 100 meters. CODE: 1-1 through 2-4 equals 1 through 9 and 0.

I am your fuel control



SOME PEOPLE identify me as that unglamorous "black box" affixed to a gas turbine engine. Others more properly refer to me as the fuel control or fuel regulator. But regardless of the nomenclature you may choose to use, one thing is certain: You depend on me to make your engine perform properly—from lightoff to shutdown. And make no mistake about it, this is no mean feat.

I'm not bragging, mind you, but if one person were assigned to perform each of my major tasks, it would require at least eight individuals—and even then, they could not perform these functions as well as I can. For example, consider some of the major parameters I must constantly monitor, sense any changes in, and respond to by reacting correctly at precisely the proper time. These include ambient temperature, barometric pressure, compressor discharge pressure, fuel pressure, throttle position, collective pitch position, compressor rpm, and power turbine rpm. Try that for size.

As you can see, I am a very busy device during my working hours. Yet, there is nothing mysterious about me, and no individual went off his "rocker" to give me birth. As a matter of fact I was never born—at least not in my present configuration. In reality, I came into being through the process of evolution. Over a period of years, I gradually changed from a simple fuel on-off valve to the complex component that I have become.

But I am not overly complicated. Actually, I consist of a number of simple systems "tied" together to function as a unit. You might compare me with a baseball team whose players are on the playing field. Each has a certain position to play. Each must observe any action that takes place, determine the response required, then perform all necessary functions properly and in a timely manner. Failure on the part of any individual to accomplish his task can cost his team the game. It's somewhat the same with us fuel controls.

While we perform the same functions, my relatives and I may differ as to how we accomplish our jobs. Some of us may rely on airflow and mechanical action to

U.S. ARMY SAFETY CENTER
Clarence J. Carter
Directorate for Aviation
Systems Management

regulate fuel flow. Some of us may use a combination of fuel flow and mechanical action, while others of us may depend on electromechanical action. The most modern of us—the new generation—sense all required parameters and control fuel flow totally by electrical means. But no matter how we do our jobs, the results are the same. We provide the power required when the operator demands it.

Gas turbine engines that power helicopters and turboprop aircraft are somewhat more complicated than pure jet engines. During the operation of a pure jet engine, my prime responsibility is to control compressor speed. I do this by comparing throttle position with actual compressor speed. The throttle position may be presented to me as an electrical impulse, spring force or cam position, but it will be proportional to the desired engine speed. I must then compare this signal with actual compressor speed to determine if I should increase or decrease fuel flow. The actual compressor speed is presented to me by a flyweight type governor driven by the compressor, an electrical generator or a speed sensitive centrifugal fuel valve. Regardless of the means, I am now able to compare actual compressor speed with the desired power setting and adjust fuel flow as required.

If the engine is a turboshaft as found in a helicopter or a turboprop fixed wing aircraft, I must consider yet another system. In these engines, the compressor acts as a gas producer to provide the force needed to drive an additional turbine. This additional turbine is connected to a separate shaft that drives the rotor or propeller and is independent of the compressor and its turbines. It extracts the remaining power from the gas stream that has passed though the compressor drive turbines.

The compressor drive turbines are known as the gas producer turbines and are designated (N1). The remaining turbines are identified as the power turbines and bear the designation (N2). By means of an electrical generator, a flyweight governor or a centrifugal fuel valve (known as the power turbine governor or N2 governor), the power turbine also sends me signals that tell me its speed. During flight in a helicopter, these signals are of prime importance to me.

The gas turbine engine has a very broad speed range and does not produce much power at low speeds. On the other hand, a helicopter requires rapid power changes. To accomplish this job, I must have complete control over the compressor. You see, the only way the gas turbine will react in a timely manner to sudden speed changes is when it is operating at near maximum rpm. That is why I have a built-in capability to prevent overspeeds and overtemps.

The helicopter pilot selects the speed at which he wishes to operate by turning the twist-grip throttle to the full increase rpm (wide open) position. At this time, I shift from compressor governor (N1) to power turbine governor (N2). With the collective pitch full down, the power turbine governor is at its lowest speed setting—if the "beep" or power turbine speed selector is at the full decrease rpm setting. Now, as the pilot adjusts the "beep" to the selected speed range, I will know at what power turbine speed or rotor speed he wishes to operate.

As "beep" is increased, I signal the compressor to speed up to the selected rpm. As I pointed out earlier, the power turbine speed now becomes my primary signal as it rotates the rotor blades, and its only connection to the compressor is the gas stream. So I must be very precise as well as quick in making any power changes so that the compressor will produce the required gas pressure.

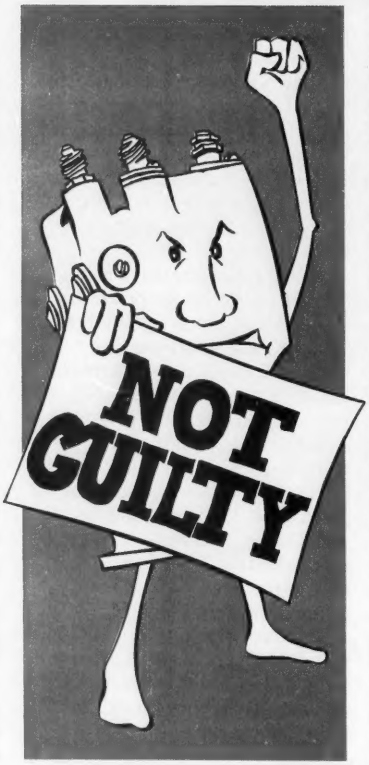
To automatically make changes during flight, I have some set procedures I must follow. If, for example, the main rotor should slow down, the power turbine governor will let me know. I will then signal the N1 governor to speed up the compressor. The result will be an increase in fuel flow that will cause the compressor to increase the gas flow enough to return the power turbine to its original speed setting. Just the opposite happens if the rotor overspeeds.

When the pilot increases collective pitch for liftoff or climb, similar events take place. The increase in pitch causes the rotor system and power turbine to slow down. Consequently, I tell the compressor to speed up to

keep the power turbine on speed. I operate in much the same fashion on a fixed wing aircraft except that the pilot has more control over the engine and propeller rpm.

So far, my job sounds fairly simple. But it doesn't end here. I have other functions I must perform with utmost precision. For example, I must be able to accelerate the compressor at the desired rate without stall, overtemperature or stagnation. And acceleration is especially critical during an engine start. To begin with, I must provide the exact fuel flow for lightoff. Then, I must increase the rate of flow in proportion to the increase in speed of the compressor. If I increase the rate of flow too fast, it will exceed the rate of increase of airflow. The fuel-air ratio will become unbalanced to the rich side, causing an overtemperature condition. If this condition becomes extreme, the engine will flame out because of an excessively rich fuel-air mixture.

And this brings up a sore point with me—compressor stall or surge. When this condition occurs, I normally get blamed for it. Yet, it is usually not my fault. As a matter of fact, the only time I'm guilty is when I fail internally. To begin with, this condition is called a "surge" because airflow reverses and "surges" in a direction opposite to that of normal flow. It is referred to as a "stall" because the compressor blades which are airfoils enter an aerodynamic stall condition.



The compressor encounters a stall when the pressure in the combustor exceeds the pressure the compressor is capable of producing. When this occurs, air flows in reverse across the compressor, cooling air stops flowing around the hot end components, and heat damage begins to occur. If the onset of the stall is sudden, a loud explosion will also occur. This will be accompanied by flame emitted from the tailpipes. This violent action occurs after normal airflow is resumed and takes place as the *correct* fuel-air mixture comes in contact with the hot end components. The resultant explosion fills the void left by the surge portion of the stall, and the pilot will actually note the overtemp indication *after* the stall has occurred. Erosion, dirty blades, or foreign object damage is usually the culprit when compressor stall occurs.

Since the acceleration compression ratio exceeds the steady state compression ratio by the same amount as the acceleration fuel flow exceeds the steady state fuel flow, compressor stall is most likely to occur while the engine is accelerating. A quick reduction in power demand will relieve the compressor load and stop the stall.

As your fuel control, I am also required to control variable inlet guide vanes (VIGVs) and usually whatever other variable devices the compressor may contain to regulate airflow. I generally control these devices as well as the compressor bleed system by means of some type of linkage and valves. Since these systems regulate airflow into and out of the compressor to prevent stall or surge, particular attention must be devoted toward insuring all linkage is correctly rigged. If these systems get out of sequence with my signal and the compressor's requirements, surge is sure to result. And the sad part is that I will get blamed. The mechanic will replace me and rerig the system, and then

everything will check out okay. Actually, rerigging of the system was all that was needed.

Another of my systems that may seem somewhat complicated concerns my temperature sensing devices. Since the gas turbine engine performance is extremely sensitive to temperature variations, I must compensate for both air temperature and fuel temperature changes. Changes in either of these can cause large changes in engine performance.

I sense air temperature by a bulb or small radiator filled with a sensitive fluid that expands and contracts as the temperature varies. This action is then transferred to a linkage inside of me that resets fuel flow in relation to compressor speed. Also connected to this linkage is another temperature sensing device that senses the temperature of the fuel. In conjunction with the air temperature, it adjusts the fuel flow as required. Needless to say, careless handling of my temperature sensing components can cause complete burnout of the engine.

Another system that must be considered is my P1 or altitude compensation system. In reality, it is an atmospheric pressure compensation system. This system is sensitive to pressure changes in the atmosphere whether I am on the ground or in the air. The heart of this system is a bellows that is calibrated to sea level atmospheric pressure. The free end of the bellows is connected by my internal linkage to a multiplier assembly. As its name implies, this unit multiplies the minute movements of the bellows into a usable mechanical force that adjusts fuel flow when atmospheric pressure changes or when the helicopter climbs or descends during flight.

As atmospheric pressure varies, fuel flow must also be varied to maintain the correct fuel-air ratio. This system is incorporated in my internal throttle linkage in such a way that it will adjust the fuel-air ratio without affecting throttle travel or response.

Now, you have a general overview of what goes on inside me. But I still have one additional major system that all the others depend on to do their respective jobs. It is my engine-driven fuel pump. This unit always pumps an excessive amount of fuel to keep my internal parts cool and lubricated and to prevent air from reaching the fuel nozzles. Depending on my type, my internal pressures range between 125 and 900 psi. In the hydromechanical units, I use small hydraulic servos controlled by small spool valves to amplify, transmit, and expand the small mechanical forces I receive from my subsystems.

My requirements to accomplish my many tasks are small, and clean fuel is the most important of all. Dirty or contaminated fuel can clog tiny ports, cause binding of delicate parts, or actually damage some intricate assembly. Just a small scratch on some of my internal parts can put me out of action. And this brings up another point.

While my exterior housing looks—and is—tough, please handle me gently when I am not installed on an engine. Just a drop of 6 inches can scramble my insides. Also, be careful when changing my fittings. Don't bang me around. I am even more susceptible to contamination and damage when I am empty. Give me a little TLC and check me periodically for external linkage wear, and I will give you many hours of safe, trouble-free operation in the air.

A Small Unit OPFOR Training Program

Major Robert W. P. Patterson
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North Little Rock, AR

IT IS A RECOGNIZED fact that today we are faced with an awesome array of military power that can be fielded by the Soviet Union and Warsaw Pact nations. This potential threat makes it imperative that we understand the capabilities and limitations of their weapons systems in order to counter them. The Army's emphasis on Opposing Force Program training is designed to help us do just that.

If you are a unit commander, a unit OPFOR officer or responsible for unit training, this program outline can give you some ideas toward getting a viable OPFOR established for your unit. The specifics may vary depending on the type of unit you're in, but the principles remain the same.

Plan Your Program. The small unit OPFOR program should begin by your meeting with and discussing the program with your unit commander. Ensure that you have his backing and get his ideas on what a really good program should accomplish. One of the determinations that must be made right away concerns the type of threat your unit would likely face. This is decided to a large degree by the type unit and mission to which you're assigned. As an example, an attack helicopter unit will likely be *equally* concerned with threat air defense systems and threat armor vehicles. Armor formations, tactics and employment techniques are all important subjects to attack units. By contrast, cargo and utility helicopter units might be interested primarily in threat air defense weapons, since they normally would not face enemy formations. The differences become even greater if you compare nonaviation units and the threats that each may consider most important (figure 1).

FIGURE 1: EXAMPLES OF THREAT INTERESTS BY VARIOUS TYPES UNITS

TYPE UNIT	THREAT INTEREST
Attack Helicopter	Vehicle/aircraft recognition Formations/tactics Air defense weapons systems EW capabilities NBC capabilities
Cargo/Utility Helicopter	Vehicle/aircraft recognition Air defense weapons systems NBC capabilities EW capabilities
Medical	Threat uniforms/insignias NBC capabilities (type casualties produced) EW capabilities
Engineer	Threat mines/explosives Engineer capabilities/technique Vehicle/aircraft recognition NBC capabilities
Signal	Vehicle/aircraft recognition Threat signal equipment EW capabilities NBC capabilities

Once you start to compare the threat to your mission requirements, you may find it will generate new emphasis on unit training requirements. For instance a signal unit might find renewed interest in unit defensive techniques when it learns that threat airborne and heliborne units consider command and control headquarters and signal installation sites to be primary targets!

Having established your requirements, you should next make a list of the assets you will need. This should include references, display items and various other training aids. Access to a "threat library" can greatly assist you. Most installations and major units have specialists involved in OPFOR training; they will be glad to assist you in getting started. Nondivisional units, Reserve Component units or isolated units can begin to establish their own reference libraries by formally requesting some of the many Department of the Army authorized publications. Various military journals, international military publications and reputable news magazines can contribute to helping establish an OPFOR file. A visit to your local Training and Audiovisual Support Center to see what is available and to discuss what support they can give you will go a long way in helping your program. Chances are, the TASCs will have more support

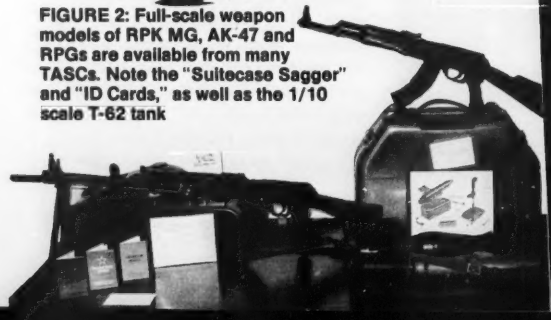


FIGURE 2: Full-scale weapon models of RPK MG, AK-47 and RPGs are available from many TASCs. Note the "Suitcase Sagger" and "ID Cards," as well as the 1/10 scale T-62 tank

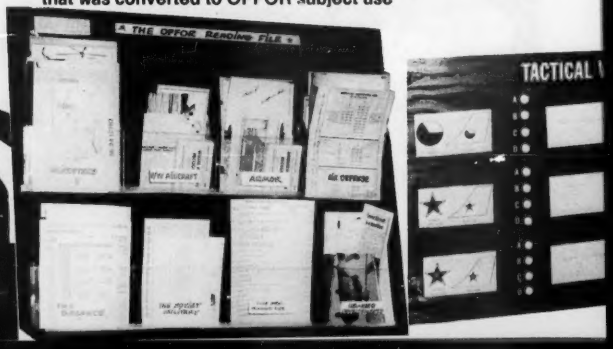


FIGURE 3: An OPFOR reading file and vehicle ID board are placed in the crewmembers' lounge for easy access. The "OPFOR File" is an old unused recruiting handout display that was converted to OPFOR subject use

The author presents some ideas that will help to establish a viable OPFOR training program in your unit. Next month in an article entitled "Whatever Happened To The Spitfire?" he discusses the important need to develop an expertise in our units to recognize and understand our allies' equipment and their military forces

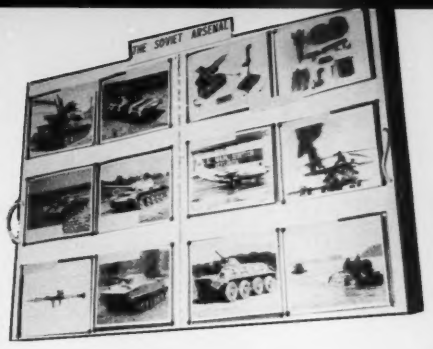


FIGURE 6: Unit made this display board. Was made from two bulletin boards with hinge in center. Rope handles allow it to fold for carrying like a briefcase

available than you think (figure 2). Also, you can contact OPFOR specialists such as the "Red Thrust" unit at Ft. Hood, TX which can give you valuable information and assistance just for the asking.

Beginning The Program. A well-prepared and well-presented briefing discussing current world problem areas such as Afghanistan, the Persian Gulf area or current opposing force capabilities is a good way to start your OPFOR program. This can be prepared locally, or you can request a "guest expert" to come in and present it for you. Follow this with a short explanation of the unit OPFOR program, and explain how this program will be incorporated into your training.

When you conduct this OPFOR presentation, you should give maximum exposure to training aids such as posters, photographs, scale models, full-size mockups, tape recordings, TV tapes and reference displays. It's not enough to just have these displays and briefings one time, but rather you must constantly update, change and modify your program to retain its validity and to promote continued interest.

As an example of how OPFOR items can be used, you might try to get a corner of the training room, crewmembers' lounge or the unit ILC to display items of interest (figure 3). What you can't readily obtain, you can often fabricate locally. A small "OPFOR" bulletin board in a frequently traveled hallway works well (figure 4). A pair of larger boards, one with a blue frame entitled "NATO Forces," and one with a red frame entitled "Warsaw Pact Forces" can provide current information and compare similar systems (figure 5). Two fiberboard "Tac-It" bulletin boards (GSA item) joined with a small aircraft hinge in the center, rope handles and document protector "frames" make a good portable picture display for talks, messhall displays or threat briefings (figure 6). A visit to the local bookstore or model shop can usually produce models of threat aircraft and vehicles, as well as U.S. and NATO equipment. A call within your unit for volunteer model builders to make these models for display is often all that's needed to give you several fine display items. This personal involvement will undoubtedly foster even greater interest in the OPFOR program.

OPFOR is a Continuing Program. OPFOR training is not a semiannual program. Threat country equipment is everchanging, just as does ours and that of our allies. As already mentioned, OPFOR information must be kept current, integrated into other training and repeated often. Every FTX and CPX should have a realistic application of OPFOR training applied as an integral part of the exercise.

Bulletin boards should be changed often and made interesting to attract attention. Every few months important subjects such as the Soviet attack helicopter, the HIND-D or the new HIND-E (You have heard of the HIND-E, haven't you?) can be shown and discussed from a different point of view. This "reinforcement" will eventually help personnel become experts on recognizing and knowing the basic characteristics of that piece of equipment and how it's employed.

The key to a good OPFOR program is "ingenuity." Your imagination and personal interest can do much to improve the OPFOR training in your unit. The work is interesting, but the subject is more than that: It is vital! The quote of an unknown Israeli infantryman following the Mideast War of 1973 states the case quite well. ***"It was nice to know that our leaders knew a great deal about our adversaries' weapons, equipment and tactics. It would have been better had this information gotten to us."***

GLOSSARY

CPX	command post exercise
EW	electronic warfare
FTX	field training exercise
GSA	General Services Administration
ILC	individual learning center
NATO	North Atlantic Treaty Organization
NBC	nuclear, biological, chemical
OPFOR	Opposing Force
TASC	Training and Audiovisual Support Center

FIGURE 4: An OPFOR bulletin board placed in a frequently traveled hallway or crew lounge works well. Other interest items such as current/proposed pay scales help attract attention

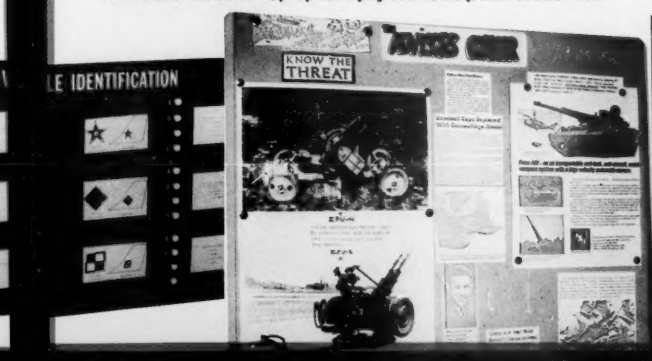
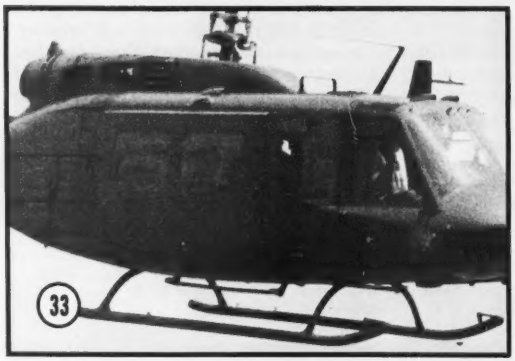
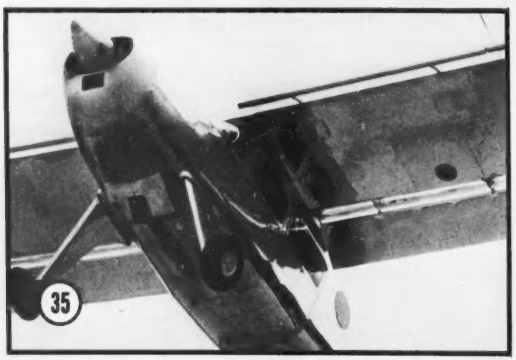


FIGURE 5: A Warsaw Pact OPFOR board in a unit (flight facility) training room. Note model aircraft (NATO and Warsaw Pact) hanging from ceiling

RECOGNITION QUIZ

Monthly Hint for November: You'll find one of the aircraft in Russia and another in Alaska.





OCTOBER 1980 RECOGNITION QUIZ ANSWERS:

25. SA-330 Puma. French Army tactical transport.
26. UH-60 Black Hawk. Utility Tactical Transport Aircraft System.
27. OH-13 Sioux. Angel of Mercy during Korean War.
28. TH-55 Osage. Dual control primary trainer.
29. OV-1 Mohawk. First purchased as AO-1 in 1960.
30. AH-1 Cobra. Replaced the UH-1 gunship.

There are no aircraft in the United States Army inventory that should be spun intentionally. Each dash 10, "Operators Manual," states: "Intentional spins are not permitted." However, it also states: "If a spin is inadvertently entered, use the following recovery procedures, etc." Therefore, spins are not being taught, but every aviator should be aware that unintentional spins do occur and must know what action to take if encountered. Army aviators may gain a better understanding of spins by reading the following articles.

Colonel Kenneth J. Burton
Director of Training and Doctrine
U.S. Army Aviation Center
Fort Rucker, AL

THE FLA
STAY AWA

SPINS ARE NO longer taught in U.S. Army Aviation. In fact, the only places left in military aviation training where spins are taught with regularity and as a part of basic flight training are in the U.S. Navy and the U.S. Air Force flight schools. The Federal Aviation Administration (FAA) does not require any spins for ratings except the flight instructor rating. Consequently, we now have a generation of Army and civilian pilots who have never seen a spin, much less ridden through one.

As an ex-Air Force flight instructor of long ago, I can tell you that spins are not all that bad. Back in the "old days," spins were taught and practiced with almost as much precision as takeoffs and landings. This taught orientation and aircraft control in unusual flight attitudes and greatly enhanced the aviator's self-confidence as well as confidence in the aircraft.

During the last several years much emphasis has been placed on "spin avoidance," partly because there is a prevalent attitude that exposing aircraft to the spin environment and the related aviator training, confidence and orientation are not worth the risk. Therefore, most of the civilian aircraft and all of the current Army fixed wing aircraft are placarded as "intentional spins prohibited." Structural design limits of most present-day aircraft restrict them from intentional spins. But let me warn you—these docile little light aircraft will spin like the knob on the proverbial outhouse door if they are not handled properly.

There are spins of many types, too numerous to cover in one article. So let me briefly alert you to one of the most deadly spins that you might encounter in a light twin—*the flat spin.*

Webster's III (Unabridged) definition of a flat spin is: "A spin in which the longitudinal axis inclines downward at a smaller angle than 45 degrees." In order for an airplane to spin, it has to be in a stalled or semistalled condition and a yawing moment (vector) must be present and a part of the aircraft (usually the high wing or wing on the outside of the spin) is attempting to fly up or over the inside wing resulting in the rotation of the aircraft. Once in a spin, the aircraft usually descends near vertically with a very high rate of descent. The attitude of the aircraft and the rapid rate of rotation are uncommon and disconcerting to the pilot who has never experienced the spin.

The flat spin can inadvertently be entered from the practice of the velocity of minimum control (Vmc) demonstrations or single engine stalls. Remember that during the approach to the Vmc

SPIN AV

WHAT are the chances that you will someday find yourself in the cockpit of an airplane that is spinning dizzily toward the ground, at an altitude that would allow time for a safe recovery if you knew how to carry out the correct procedure?

Pretty low. Spin accidents in general aviation have been averaging about 140 per year in recent years, according to the

AT SPIN-
AY FROM IT

Wilburn James
Directorate of Evaluation/Standardization
U.S. Army Aviation Center
Fort Rucker, AL

demonstration, the critical or left engine is either shut down at the zero thrust or windmilling. At any rate, there is no thrust being developed by the left engine and maximum allowable or takeoff power is set on the right engine. Aerodynamically, this creates considerable asymmetric thrust. Further, as the aircraft approaches Vmc, the Aircrew Training Manual (ATM), TC 1-145, states that you must maintain heading within plus or minus 10 degrees and 5 degrees bank angle into the operating engine. As the airspeed decreases toward Vmc, the aircraft requires more right rudder if you are to maintain directional control, more right aileron to maintain 5 degrees bank into the operating engine and the asymmetrical power condition is increasing. When you bank 5 degrees into the live engine, you lower the right wing and cause the aircraft to enter into a sideslip toward the right. This procedure causes the input of the right aileron (resulting in the right sideslip) to lessen the amount of right rudder required to maintain directional control within the prescribed limits. *Note:* This method was advanced by the aircraft manufacturers and accepted by the FAA for the purpose of obtaining a lower published Vmc. Now, you certainly can't maintain altitude or maneuver or even land the aircraft in this sideslip condition. *Think about this!*

A Word Of Caution: The Vmc speed that you have determined from the performance chart is a close approximation determined by using the 5-degree angle of bank into the operating engine. This is a misleading figure, if an attempt is made to maintain wings level and straight directional control. The wings level speed will be greater (usually 5 to 10 knots) than the speeds derived from the performance charts. It is wise to keep this in mind if you should experience an engine failure prior to reaching safe single engine airspeed.

As the airspeed approaches Vmc, the aircraft is in a 5-degree bank, right aileron is deflected, and full right rudder is applied with maximum or takeoff power on the right engine. The left wing is higher than the right wing; therefore, it has a higher angle of attack. (Remember that a wing stalls because of excessive angle of attack.) Also, the aileron deflection to hold the 5 degrees of bank now has the right aileron deflected upward into the area of low pressure, or less drag, and the left aileron deflected downward into the area of high pressure, resulting in more drag on the left wing than on the right wing. This unequal drag produces a yawing movement to the left. This sideslip effect causes more profile drag (keel effect) as the fuselage is moving sideways into the relative wind; this disrupts the airflow over the left wing area near the fuselage reducing lift and adding to the stalled condition of the left wing.

At precisely Vmc the left wing stalls. The right wing continues flying and lifts up and over the left wing or inoperative engine. Also, the thrust and slipstream effect of the operating right engine tend to keep the right wing flying longer and add to the rolling and turning moment toward the left or inoperative engine. You were in a climbing attitude when you reached Vmc. As the stall and roll progress, the nose will pitch downward and begin to rotate to the left. (Remember the control input that you had at the moment of Vmc: full right rudder for directional control; full right aileron for bank control; full back on the elevator for pitch or attitude control; and full power on the right engine.) If the proper recovery procedures are not immediately undertaken, you are now entering a spin and very likely the *flat spin.*

If spin recovery information is not available for your aircraft, generally the recommended spin recovery techniques are as follows: If the spin is *flat*, the nose will usually oscillate from 20 to 30 degrees below the horizon then up to the horizon or slightly above (depending on the particular aircraft) and a rapid rate of rotation accompanied by a rapid rate of descent.

First, reduce the power on the operating engine. Apply full rudder against the direction of spin, full forward elevator control, and neutralize the aileron. If this procedure is successful, the rotation will usually slow or stop within three to five turns.

If this method is unsuccessful, *then use the second procedure* – full rudder against the direction of rotation, full forward elevator, full aileron into the direction of rotation and full power on the engine on the inside of the spin. If you are confused as to the direction of rotation, then add power on both engines. Usually this method will effect recovery within three to five turns. Remember, you are losing altitude at a very rapid rate, but don't panic; give the controls a chance to take effect. After all, you have no parachute, and it is very likely that you will effect recovery. As the rotation slows to a stop, adjust power to idle, neutralize the controls, and *s-m-o-o-o-o-t-h-l-y* recover from the ensuing dive.

If you do not release the controls as the spin stops, you could force the airplane into another spin in the opposite direction. *REMINDER: Use extreme caution when operating in an environment conducive to entering spins. If you inadvertently enter a spin, don't panic. FLY IT OUT!*

WARENESS

The *Aviation Digest* thanks the *FAA General Aviation News* for permission to reprint this article.

National Transportation Safety Board, but fewer than 5 percent of these spins developed high enough above the ground to allow for a normal recovery. Of course that is only part of the picture, since we have no data concerning the number of pilots who were able to pull out safely from an inadvertent spin and continue happily on their way. Chances are this number is not high either, because pilots who are able to extricate themselves safely from an unintentional spin are usually pretty savvy about avoiding it in the first place.

We do know for a certainty that spins which culminate in an accident are more likely to cause fatalities than any other category of accident cause. In 1977, the latest year for which figures are complete, there were 147 spin accidents; 121 or 82 percent of these were fatal, with 206 fatalities. The proportions are

SPIN AWARENESS

typical for recent years. *No other category of accident—even mid-air collisions—has as high a rate of fatal accidents.*

As with stall awareness (See September/October issue of *FAA General Aviation News),* spin awareness requires a habit of constant alertness toward the conditions of flight. Inadvertent stalls and spins most often occur when the pilot is either busy with cockpit duties—as in landing or takeoff—or when his attention is drawn away from the airplane because of other interests (crop dusting, search and rescue, forest or pipeline patrol, aerial photography, sightseeing, buzzing, etc.). Inflight mechanical problems or difficulties with weather also can be distractions which lead to loss of control. Spin recovery skills are little help when a pilot allows an airplane to enter a spin at an altitude too low to effect a recovery. An ounce of prevention here is worth many pounds of cure.

Pilots who wish to gain some experience in spin maneuvers are advised to begin with several hours of dual instruction from a certificated instructor, preferably one who has special experience in spin training. All pilots can benefit from a basic understanding of spin aerodynamics. A spin is often a confusing maneuver, with many unpredictable aspects that vary according to make and model, cabin loading, and other conditions, but the basic procedure for entry and recovery is fairly standard.

What is a spin? Theoretically, a spin can be described as a rapidly descending maneuver in which the airplane rotates about its vertical axis with unequally stalled wings. From the pilot's point of view the event is apt to be experienced in much more exciting terms.

All spins are preceded by a stall, but under some circumstances there may be little or no buffeting and the aircraft may appear to move directly from a yawing turn into a spin as the nose and one wing drops down.

Rotation speed builds up and the flight path becomes nearly vertical. At the completion of the first turn the nose may come back up and then pitch down again. By the end of the second turn the spin may be fully developed, as the rolling, pitching and turning motions become somewhat repeatable and stabilized from turn to turn. Airspeed is approximately stall speed, with the stall warning horn and lights signalling intermittently. Descent rate is significant, ranging from approximately 5,000 to 8,000 fpm in light single-engine planes. Stress load is minimal and not likely to cause damage even to an aircraft that is not designed for spinning (although stress damage can occur during recovery with excessive "G" loads). The pilot may become dizzy or disoriented, especially if he stares at his spiralling wingtips.

Recovery from the spin involves arresting the rotation with rudder, breaking the stall by reducing the angle of attack on the wings and pulling out of the dive smoothly and positively without inducing excessive load factors on wings or tail assembly of the airplane.

Many aircraft will stop spinning if the pilot simply reduces power to idle and takes his hands and feet off the controls. However, unless the pilot promptly resumes control, the airplane may continue in a spiral descent.

A spiral dive, incidentally, is often confused with a spin, and it is important to be able to distinguish between the two. In a spin the aircraft remains stalled, with little or no aileron response, and a fairly stabilized airspeed and attitude. In a steep spiral the aircraft is not stalled; the bank angle may steepen; and the airspeed may build up excessively in a short time. One clue is in the airspeed indicator; in a spin it will not read much above stall speed. Recovery procedures are not alike, and if inappropriately applied could worsen the situation. Subjective impressions are not reliable.

Basic Spin Recovery

1. Reduce throttle to idle and neutralize ailerons.
2. Apply and hold full rudder opposite to the direction of spin. If unable to determine direction of rotation, refer to turn indicator. Disregard ball indicator--it will not be reliable.
3. As rudder pedal reaches the stop, move control wheel briskly forward to break the stall. Full down elevator may be required.
4. Hold these inputs until rotation stops (may require a full turn or longer).
5. As rotation stops, neutralize controls and smoothly recover from resulting dive. Retract flaps before exceeding flap extension speed.

This is the basic procedure for most light, single-engine aircraft, and it also applies to most light twins. With some twins, if normal procedures do not result in recovery, power from the engine in the down wing can be used to stop rotation, but if the wrong throttle is advanced the results could work against recovery. Airplane spin characteristics vary broadly, so defer always to the recommendations of your manufacturer.

Caution: The principles outlined above are for general understanding, and are NOT intended as guidelines for self-instruction in spin recovery practice. No one should deliberately spin an aircraft without prior dual instruction.

NOTE: Since an aircraft spins around its center of gravity, aircraft loading affects recovery. In general, the farther forward the center of gravity (within allowed limits), the more responsive the rudder will be in stopping rotation. An excessively aft CG will reduce the effectiveness of the rudder and make it more difficult (perhaps impossible) to recover. That is why many aircraft are placarded against spins with passengers in the rear seats. Even in a (side by side) two-seater, when recovery is sluggish, pushing the pilot seats as far forward as they can go may help.

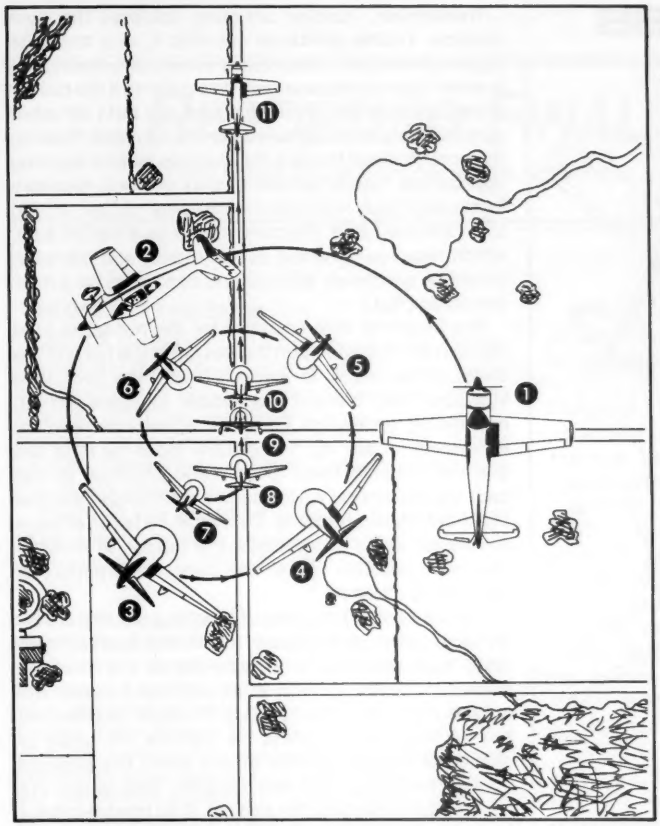


Figure 1. The first two turns of a spin and recovery as seen from above. The apparent tightening of the spin is due to perspective. (1) The area is cleared, the airplane is lined up with a road and the power is reduced. The nose is raised to stall attitude and, as the stall is approached, left rudder and full up elevator are used. Some airplanes may require opposite aileron at the entry; others may need a burst of power (then reduced to idle) at this point. (2) The airplane is the transient condition; some airplanes may move over to a slightly inverted position during this phase. (3) The spin is developing.

(4) The rudder and elevators are held in the full deflected position. (5) Note that the path of the airplane is quite different from the spiral in that the airplane is flying a helix angle and is *also* rolling and yawing about its center of gravity. (6) The recovery may be started here or at (7), depending on the airplane being used. (8) The rotation has stopped and at this instant the airplane is in a straight stalled condition. (9) The nose is lowered to break the stall. (10) The pull-out is started. (11) The airplane is brought back to straight and level cruising flight. Be sure the recovery is complete at least 1,500 feet above the surface.

Figures 1 and 3 reprinted by permission from THE FLIGHT INSTRUCTOR'S MANUAL by William K. Kershner © 1974 by the Iowa State University Press, Ames, Iowa 50010.

The rudder is the key control surface, both in spin entry and recovery. The dominant cause of the inadvertent spin is exceeding the critical angle of attack for a given stall speed while executing a turn with excessive or insufficient rudder—*an uncoordinated turn*. In a sense, the lack of coordination could also be ascribed to insufficient or excessive aileron, but when the airplane approaches stall speed the ailerons may be nearly or completely unresponsive—at a stage where the rudder is still fairly effective. The spin normally goes in the direction indicated by the rudder; i.e., holding left rudder will normally give you a rotation to the left, right rudder will normally give you a rotation to the right, regardless of which wing tip is raised.

In a skidded turn (to the left, for example) it seems natural to expect that if a stall and spin develop, the rotation will be with the rudder, since the left aileron and rudder are being held. But in a slip, with opposite aileron held against the rudder, it comes as a surprise to some pilots to find that if a spin develops the wing will usually roll over against the held aileron.

It is also important to remember that in an uncoordinated maneuver such as a slip, pitot/static instruments, notably altimeter and airspeed, are unreliable (because of the uneven distribution of air pressure over the fuselage). Unless the pilot is very attentive to the feel of the controls he may not realize he has exceeded the critical angle of attack until he hears the stall warning horn, and by that time it may be too late to avoid a stall and possibly a spin.

The slip, incidentally, is a maneuver which historically developed as a means of burning off excessive altitude during an approach to land without turning or going around, in airplanes without wingflaps. Some pilots and instructors now advise against its use at low altitudes, because of the possibility that with insufficient airspeed a stall and spin could result. S-turns are considered by some as a better way of losing altitude; if they do not suffice, a go-around is likely to be a safer maneuver than a slip close to the ground, where unexpected turbulence could easily convert the slip into a deadly spin.

SPIN AWARENESS

Figure 2. Rudder effect.

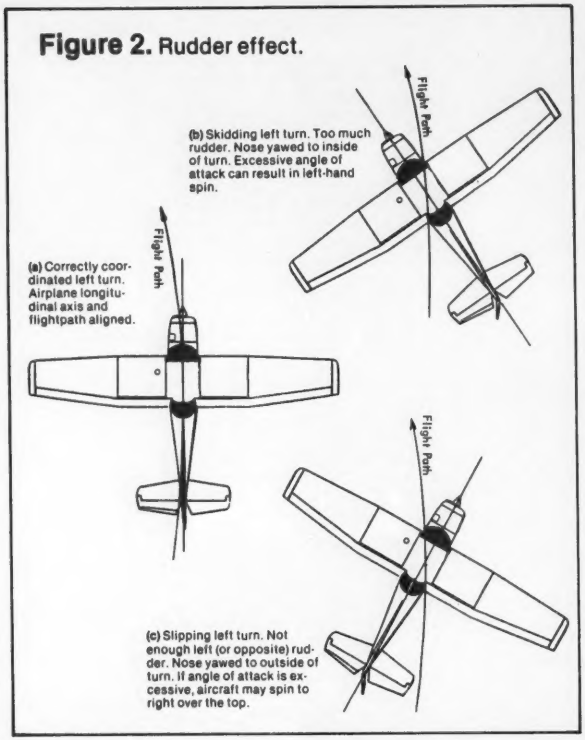
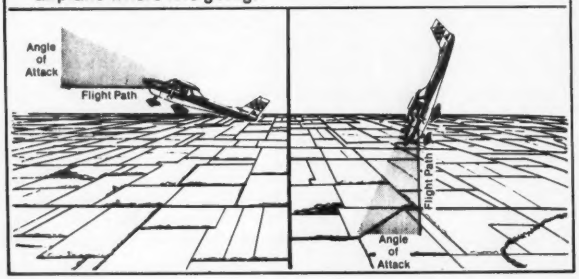

Flight Path
(b) Skidding left turn. Too much rudder. Nose yawed to inside of turn. Excessive angle of attack can result in left-hand spin.
Flight Path
(a) Correctly coordinated left turn. Airplane longitudinal axis and flightpath aligned.
Flight Path
(c) Slipping left turn. Not enough left (or opposite) rudder. Nose yawed to outside of turn. If angle of attack is excessive, aircraft may spin to right over the top.

Figure 3. Angles of attack in the normal power-off stall and in a spin. To recover from either, you have to point the airplane where it is going.



Remember, *rudder pressure* initiates the spin rotation, *rudder pressure* sustains it, and *opposite rudder pressure* is the primary means of arresting the rotation. (Some airplanes will stop rotating if the rudder pressure is simply released, some will not.) All other control inputs are likely to worsen the situation. Pushing the control wheel forward, for example, before applying appropriate rudder pressure, may prolong recovery because of increased blanketing of the rudder, or lead to an inverted spin. (Recovery from an inverted spin, which requires reversed use of rudder and elevator, would be extremely difficult and confusing for a non-aerobatic pilot.)

The length of time required for the rudder to stop the turn will depend upon the design of the tail and the angle of the attack. In a spin attitude, the horizontal stabilizer may blanket the rudder to some extent, depending on design because of the near-vertical movement of air. No matter how close he is to the ground, the pilot must resist panic impulses to pull back on the control wheel before the rotation and the stall have been overcome. Care must be taken as soon as rotation stops to neutralize the rudder, in order to prevent a possible spin in the opposite direction, or recovering inverted.

The only certain method of breaking out of the stall is reducing the wing angle of attack and recovering to level flight smoothly and positively as the airspeed builds up. If the ground is already very close, the outcome may be in doubt, to say the least, but the pilot has no alternative. Unless he reduces the angle of attack with down elevator at this point, the airplane may immediately stall and possibly spin again. He must trade off altitude for control. If an impact cannot be prevented the less control the pilot has, the poorer his chances of survival. Attempting to increase airspeed by opening the throttle prematurely is likely to pull the nose up excessively and bring about an accelerated stall.

Avoiding that sinking, spinning feeling at a low altitude is a matter of constant control—and of maintaining airspeed and attitude appropriate to the maneuver being carried out. Specialized pilot training and study, however helpful, do not eradicate the tendency of an airplane to stall and spin under favorable conditions. Furthermore, an airplane which recovered easily from a spin under one set of circumstances may resist recovery strongly under other circumstances. A slight modification of the airfoil (from icing, for example, or dried mud), a small change in the configuration—even an uncalculated change in density altitude over high terrain could affect recovery time, with serious consequences.

Perhaps some day a spinproof aircraft will be designed. Meanwhile, expect them all to be potential dervishes. Don't turn them on.

(NOTE: The editor acknowledges with thanks the assistance of Mr. Sammy Mason Sr., a veteran test pilot and author of a forthcoming book on spins; and the advice of Mr. James Bowman, spin expert at the Langley Research Center.)

REPORTING FINAL

Late News From Army Aviation Activities

FROM FORT RUCKER

GRETA Graduates. The first people at Ft. Rucker to complete the 80-hour program of instruction in the operation of the Ground Radar Emitter for Training Aviators (GRETA) are Staff Sergeant Hubert L. Brannon and Sergeant Terry E. Mann, Lowe Division, Department of Flight Training, Directorate of Training and Doctrine.

They will use the training device to supplement radar warning receiver training given in various flight courses at the U.S. Army Aviation Center.

New Instructors. Lieutenant Colonel (P) Ernest F. Estes, left, director of Training Developments at Ft. Rucker, AL, congratulates Staff Sergeant Hubert L. Brannon and Sergeant Terry E. Mann, second and third from left, on their being trained as instructors for the Ground Radar Emitter for Training Aviators (GRETA). With the course's first graduates are Staff Sergeant Edmund C. Zayas, second from right, course instructor, and Captain Lawrence J. Buehler, representing Ft. Rucker's Directorate of Training and Doctrine.

Photo by SP4 Deb Ellis

GRETA has optical and radar capabilities to provide flexibility in the selection of threat electronic emissions to teach student and rated aviators. In addition to Ft. Rucker's, there are GRETAs at Ft. Campbell, KY, and Ft. Hood, TX, and one is scheduled to be fielded next spring in Europe. See the July 1980 *Aviation Digest,* page 40, for further details on this device.

Broken Wing Award. Chief Warrant Officer, CW3, Thomas B. Smith, an instructor and test pilot with the U.S. Army Aviation Development Test Activity, has received the Broken Wing Award for his action which prevented serious damage to a CH-47 Chinook helicopter.

The mishap occurred during a training flight when the automatic flight control system of the aircraft malfunctioned while it was on the ground, causing erratic changes in its levelness.

CW3 Smith got the Chinook airborne and managed to maintain control until the problem could be found and corrected.

Graduation Speakers.

• *Major General Joseph T. Palastra,* commanding general of the 5th Infantry Division (Mechanized) and Ft. Polk, LA, was guest speaker for 26 graduates of the Army Aviation Safety Officers Course.

Proving their value to commanders through providing meaningful safety standards for their units is very important, he stressed.

"One aviation safety officer who has established his credibility...is worth his weight in solid gold," he said, adding, "I can tell you that after having had both kinds."

• *Major General James B. Vaught,* director of operations and readiness, Office of the Deputy Chief of Staff for Operations and Plans, Washington, DC, spoke to graduates of three flight training classes.

"The most important social responsibility of a government is to provide an adequate defense," he said; and he emphasized the important role that Army Aviation plays in helping that responsibility to be met.

"The role of Army Aviation is unique," he said.

REPORTING FINAL

"Not only do we use aircraft in combat, but aviation has to support and provision itself and the front-line troops. That is why its speed, agility and flexibility is so valuable." **(USAAVNC-PAO)**

Information For MOS 93H/J Personnel. Correspondence courses are now available for military occupational specialties (MOS) 93H/J trainers and trainees in skill levels 2, 3, 4 and 5. Many subcourses feature a new design which requires students to perform MOS critical tasks to the satisfaction of their supervisors who actually score the tests. The commanders also get involved, since completion of these subcourses requires their certification.

While the training should lead to improve skill qualification test scores, students in pay grades E1 through E5 also earn one promotion point for each five credit hours of correspondence work completed. Courses available include the following:

- Primary Technical Courses (the correspondence course number is R14 for 93H; R34 for 93J) train to skill level 2.
- Basic Technical Courses (R17 for 93H; R37 for 93J) train to skill level 3.
- Advanced NCO Course (course number is S12) trains to skill level 4.
- Senior correspondence courses train to skill level 5. There are two: a radar option (Air Operations—CMF64—NCO Senior Course-Radar Option, course number is T02) which trains 93H40 to 93J50, and a tower option (Air Operations—CMF64—NCO Senior Course-Tower Option, T03) which trains 93J40 to 93J50.

Of special future interest will be the integration of newly developed training extension course (TEC) lessons into the correspondence courses to train Soldiers *HOW-TO* install the AN/TSQ-70A (tactical control tower) and the AN/TSQ-71A (tactical GCA radar). The new training materials (both TEC and correspondence subcourses) should be available in the March/June 1981 timeframe.

Some of the changes are not reflected in the current U. S. Army Aviation Center correspondence course catalog (DA Pam 351-20-3) so it may take a phone call to find out or confirm the status of a course or subcourse. You may do this by calling the Army Correspondence Course Program liaison officer at Ft. Rucker, AL, AUTOVON 558-3703/3668, or the Army Institute for Professional Development, Ft. Eustis, VA, AUTOVON 927-3085.

To enroll in one of the 93H/J correspondence courses, complete DA Form 145 and mail to: The Army Institute for Professional Development, U.S. Army Training Support Center, Newport News, VA 23628. **(USAAVNC-DTD)**

Photo by SP4 Deb Ellis

RU-8D Accepted At Museum. Thomas J. Sabiston, left, curator of the U. S. Army Aviation Museum at Ft. Rucker, AL, accepts the logbook of the RU-8D from Richard L. Anderson, pilot, while Jim Craig, assistant curator, looks on. The plane will be permanently displayed at the museum. Mr. Anderson is a maintenance supervisor with the U. S. Army Reserve Aviation Support Facility (USARASF) in Orlando, FL, which maintained the aircraft for the USAR 138th Aviation Company (Electronic Warfare)

FROM FORT HUACHUCA

Request for C-E Topics. Military communicators around the world are asked to provide Communications-Electronics (C-E) topics to be addressed in the 1981/1982 timeframe.

The request comes from the U. S. Army C-E Engineering Installation Agency (USACEEIA) here, which represents the U. S. Army Communications Command (ACC) as a member of the Tri-Service Engineering Installation Steering Group.

What is requested is input from potential users on future requirements. It should be addressed to: Commander, HQ, USACEEIA, ATTN: CCC-CED-STD, Ft. Huachuca, AZ 85613.

In addition to establishing a basis for engineering study requirements, the information will be included in the technical manual/field manual program. **(PAO)**

FROM ALASKA

Emergency Help. A Ft. Wainwright helicopter crew played a vital role in averting a potentially disastrous situation at the Fairbanks International Airport recently.

CPT Richard Marsden and Chief Warrant Officer, CW3, Jeff Alley, flying in an AH-1G Cobra, helped a frightened woman, a nonaviator, land a small airplane when her husband passed out at the controls.

Mr. and Mrs. John Chalupnik had just taken off from Phillips Airfield, 2 miles north of Fairbanks,

when Mr. Chalupnik complained of a severe headache. He suddenly pitched forward, unconscious.

"We got the first call on an emergency frequency shortly before 3 p.m. and immediately prepared for a possible disaster," said Don Johnson, team supervisor at the Fairbanks Air Traffic Control Tower. "We made the only decision possible...to guide her in."

CW3 Alley and CPT Marsden, both assigned to E Troop, 1st Air Cavalry, had been flying a routine training mission over Ft. Wainwright when they were contacted about the emergency at Fairbanks International. "They told us briefly that they had a plane in trouble and we asked if we could help. When they said yes, we were out there in a matter of minutes," CW3 Alley recalled.

When the Wainwright crew arrived on the scene, Mrs. Chalupnik was trying to manage the single-engine Super Cub while receiving radio instructions from the Fairbanks tower. "Under the circumstances, she was doing a great job keeping the plane in the air. Mr. Chalupnik had passed out over the controls, so she had to maneuver around him from behind," Mr. Johnson explained. He added that Mr. Chalupnik's feet had totally blocked all control of the plane's rudders.

The Army aviators initially took up a position behind the faltering craft. "We didn't want to scare her, but soon we had to move out in front so we could lead her in," explained CW3 Alley.

"We just wanted to line her up with the main runway and bring her straight in."

Familiarizing herself at the controls with help from the tower, Mrs. Chalupnik followed the Cobra as it descended to the runway. "She was doing a good job of keeping the wings level and the nose up," CPT Marsden said, "but she had difficulty making right turns, so we made sure it would be one straight line to the landing strip."

Within the tight confines of the plane's cockpit, Mrs. Chalupnik actually had to stand up to operate the controls over her husband. "It's like trying to navigate a car through a tricky road course from the backseat with the power steering broken down," is the way CW3 Alley, a fixed wing pilot himself, described the predicament.

Attendants at the Fairbanks tower got a last-minute scare when it appeared the disabled plane was descending too fast on final approach.

Mr. Johnson described what he saw unfold from his vantage point in the airport's tower:

"As she approached the main runway, she started rapidly losing altitude and it looked as though she might hit an iron lighting structure at the base of the runway. We instructed her to give it more power which boosted the plane up and over the light stanchion.

"The surge of power caused the plane to veer away from the targeted runway in the direction of the tower. We thought she had totally lost control at that point," Mr. Johnson remembered, "but luckily she ended up on line with a smaller secondary runway in front of the tower. We didn't want to risk another pass, so we told her to cut power, pull back on the stick and set it down."

With emergency crash vehicles converging on the scene, Mrs. Chalupnik brought the plane down with a couple of hard bounces. Narrowly missing another plane that was taxiing in the area, the Super Cub skidded along the runway before veering off into a ditch and overturning.

Joan Chalupnik was uninjured in the crash. However, her husband died of a brain hemorrhage a few days later in an Anchorage hospital.

"I've been doing this for 23 years and believe me, I've never seen anything like this before," declared Mr. Johnson. "It's just amazing that something like this, with such a high chance of instant disaster turned out so good.

"We can be thankful for the Army's help. They were right here when we needed them because the Army has always been good about helping out whenever possible.

"It's just a great feeling to know we had a part in the whole thing," CW3 Alley said with a smile. "For awhile it looked as if it might go the other way, but the lady kept her cool throughout. It's like a scene from a movie or something."

CPT Marsden summed it up when he said, "The good Lord was with all of us that Sunday."

(SP4 Seth Hamilton)

FROM WASHINGTON

HSM Approved. The Humanitarian Service Medal has been approved as a means to recognize the personnel who directly participated in the Gallup Indian Medical Center Relief Operation in Gallup, NM, during the period 3 October 1979 through 15 April 1980. See MILPO Message No. 80-241, 231919Z Sep 80, or call AUTOVON 221-8698/8699.

(MILPERCEN)

Only 2 Months Away. Starting with the January 1981 *Aviation Digest,* there will be an article authored by the DA ODCSOPS Army Aviation Officer. It will appear quarterly thereafter and will cover all aspects of Army Aviation. Suggested topics to be addressed are welcome by telephone, AUTOVON 227-9666 or message to HQDAMO-RQD.

(ODCSOPS)

SAFETY: BUILDING FROM THE GROUND UP

CW3 Rexford W. Swartz
Safety Officer, 9th Aviation Battalion
9th Infantry Division
Fort Lewis, WA

THE IMMEDIATE overwhelming question, "Where do I start?" can cause safety officers to sit back and assume a passive role while waiting for information to be presented to them. Many safety officers in the Army operate in this role and find it hard to extricate themselves from that role. You, the safety officer, must *attack* the job of accident prevention. This attack does not imply making rapid changes in existing programs immediately, based upon your past experience, but rather suggests a timely change based upon information that you have actively pursued and acquired in the unit. I would like to share with you a few techniques that I have employed to get started. I will concentrate on the importance of statistical analysis of accident reports as valuable tools in the accident prevention effort.

The first phase in establishing an effective safety program is to enter an information gathering process, which gives the most information on every aspect of the unit in the shortest time. It is critical that the safety officer establish a concept as to what the problems of the organization have been. Past experiences with other organizations are valuable tools and a source of wealth from which the safety officer may draw; however, past experiences and past methods should be drawn upon and used only at the appropriate time.

Let's look at the information gathering process and how it can aid a safety officer in rapidly gathering information about the unit. Imagine reporting to your office on the first day of work and sitting down at your desk which already has an in-box full of assorted papers and safety publications. The question, "Where do I start?" will probably be foremost in your mind. Most safety officers will go immediately to the in-box and begin sorting through the material, or they may decide to go out and look around the flight line—but, let's stop there; there are a million things that can be done. Let's initially formulate a plan and a logical sequence of events. It is extremely difficult to make decisions on safety matters until one has a feel for the organization and knows how those decisions will affect the organization. Let's begin the information gathering process by gathering all the information we can from right here in the office.

A good first step would be to extract all DA Forms 285, Accident Reports, from the files. These may go back several years—but, why not pull the last 3 years? Our intention in reviewing these more recent ground-related accident reports is to identify possible trends within the organization. From the DA Form 285 reports, you will be able to gather information in three main areas: disabling injuries, Army motor vehicle accidents and privately owned vehicles accidents. Read each 285 report and annotate on a separate sheet of paper the main cause factor and contributing factors in each accident. There is no magical list of cause factors by which to go; use your head and reason out what you feel the cause factors are. Determining cause factors will be a much easier task as you gain experience in this area. Once a cause factor has been listed on the sheet, add a mark next to it each time it is encountered on succeeding reports. Once you have worked your way through a year's worth of reports, total the number of occurrences in each area. For example, you may find that for the year 1978, improper backing was a main cause factor in five occurrences while speeding occurred in nine accidents. Possibly icy roads were a contributing factor in 13 mishaps. Studying this data begins to give the safety officer a feel for what

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CW3 Swartz wrote this article while attending the Warrant Officer Senior Course at the U.S. Army Aviation Center, Ft. Rucker, AL

Newly assigned aviation safety officers now find themselves confronted with developing both a ground and aviation unit safety program. This could be a formidable task—it was for me

problems drivers are having in driving Army motor vehicles. After 1 year of reports have been reviewed, go to the next year, and the next, until you have reached the present time-frame. As you compile each year's cause factors and compare them, you will begin to recognize possible trends—recurring problems from year to year, or cause factors which are increasing in frequency with each new year. At this point the safety officer can formulate possible corrective actions to minimize particular cause factors. If the proposed plan is effective, and the cause factor you are trying to minimize has been recurring, you will possibly find a net reduction in the accident rate for the following year. This result suggests that a similar statistical analysis be made at the end of each succeeding year. This technique offers a method of evaluating previous efforts to minimize a particular cause factor and helps identify new factors on the increase. You should now have a better feel for the unit's Army motor vehicle operations, driving characteristics of off-duty personnel, and cause of injuries to on- and off-duty personnel.

The second step is to review all Preliminary Reports of Aircraft Mishaps (PRAMS). Conduct your analysis using the same method as for ground accidents. The analysis will reveal, for example, cause factors of improper torque, materiel failure and maintenance error. The safety officer will begin to recognize what caused problems in the past and resulted in aborted or terminated missions.

Your next source of useful information is the safety files—specifically fire inspections, annual general inspections, aviation readiness inspections, and Occupational Safety and Health Act inspections. Inspection results may reveal problems in shop or maintenance procedures. It should be remembered that the unit was possibly at a better preparedness level during inspection than it was for the rest of the year. Writeups on inspection reports may provide partial explanations of cause factors previously compiled during the review of the PRAM file. For example, an inspection entry for "torque wrenches overdue calibration" could explain three or four instances of overtorque as a cause factor found in the PRAM file review.

At this point you, the safety officer, have established certain assumptions about the organization based upon your analysis of statistical data. Now is an opportune time to review the unit standing operating procedure (SOP), which should state how the unit goes about accomplishing its mission. You can now view the SOP with a more critical eye as you have already recognized some possible problem areas. If, from your statistical analysis, you had determined that a problem existed in the calibration program or if it had been noted that weather conditions were factors in several Army motor vehicle accidents, you might pay particularly close attention to the unit's calibration program and vehicle dispatch procedures, as outlined in the SOP. You might find that the SOP is shallow in its outline and does not really affix responsibilities for all individuals concerned. On the other hand, you may find a beautifully presented program which fully outlines the concept of operation. One example would possibly indicate a loosely run, not well-thought out program which would require additional emphasis and re-structuring to strengthen the program. The beautifully outlined example would leave open the possibility of a source of interference that did not exist when the program was written or very poor monitoring procedures to ensure compliance with the previously established program.

As a specific example, in the case of weather in regard to Army motor vehicle accidents, you may look into foul weather dispatch procedures. Is there a plan for the dispatch of vehicles during hazardous driving conditions? When will the vehicles be dispatched? Is dispatch approval required and by whom? What special procedures are in effect? Study of the SOP will have more meaning now that you have learned something about the unit prior to reviewing its SOP.

The fifth and last step before getting out to take a look at the organization itself is to review the preaccident plan. It must be reviewed to obtain an idea of who has what responsibilities in the event of an aircraft mishap. Time is crucial immediately after an aircraft mishap; appropriate personnel should be aware of their responsibilities under the program. Since an accident could happen at any time, we must ensure that there is a valid plan.

The next step is to get out and look at the facilities and meet key personnel within the organization. The term "key personnel" refers not only to the chain of command but also to those talented personnel within the organization whose recognized expertise and acceptance within the organization "makes things happen."

A detailed survey of the unit should occur later; the purpose of this preliminary visit is to listen and to gain some initial impressions. The safety officer must learn about the personnel performing the job and identify personnel who display expertise in given areas. These personnel will prove important later in establishing standards and monitoring standardization of procedures. Ask questions to find out more about how the organization actually operates and what the personnel feel the problems are. This effort of asking questions and listening is worthwhile and could cap your information gathering process. Your visit may provide indicators as to morale of troops, pride in job or shop, organizational supervision and training and as to whether sufficient resources are provided to accomplish the mission.

The information gathering process is the first step in developing an effective safety program. It provides required data upon which the safety officer can base managerial safety decisions. The information gathering process does not end here but must be constantly, actively massaged to keep abreast of the organization. The efficiency of any organization is cyclic, especially in the military, as personnel changes and new priorities add their influence to the organization. To be able to recognize new variables and to react to them in a timely fashion—these are the keys to operating a consistently effective safety program.

Evolution Of Instrument Flying

DURING THE EARLY years of aircraft development, challenges such as stability, speed, altitude and range were foremost in the minds of engineers while little thought or effort was directed toward giving aircraft an all-weather capability. Flying was restricted to favorable weather, and attempts to fly in areas of limited visibility often ended in disaster. As aviation technology advanced, pilots vividly realized the necessity of having a system which pilots could refer to for controlling their aircraft when visibility became restricted. Out of this need, flight instruments and instrument flying procedures evolved.

In 1932 a system for aircraft control by reference to instruments was introduced to train airline pilots under simulated instrument flight conditions. This system, "The 1-2-3 System of Aircraft Control," consisted of three successive steps: center the turn needle with the rudder, center the ball with aileron control and control the airspeed with the elevator. Although this system of control was not coordinated nor did it take advantage of the pilot's ability to fly by visual references, it was a way to keep the aircraft's wings level and to maintain straight flight when visibility was restricted.

The Army soon adopted this system, but called it the "Needle-Ball-Airspeed" system. It was taught in Army flight training schools for many years as the standard method of aircraft control. Because of its many limitations, this system was used only when climbing and descending through overcast conditions and as a safety factor when the pilot had the misfortune to be "caught on instruments" while en route.

During the mid-1930s an instrument that was destined to revolutionize the art of instrument flight began to appear on the panel. This instrument, then called the "artificial horizon," contained a gyroscope; it used the gyroscopic property of rigidity in space to give the pilot a plane of reference. Although this instrument had several limitations, including the tendency to tumble, it *was* effective for controlling the aircraft during instrument flight.

Other precision flight instruments were being developed and installed during this period. The sensitive altimeter with a pressure compensating device enabled the pilot to maintain altitudes more accurately and to perform approaches safely. The "directional gyro" gave the pilot much better control of the aircraft heading during instrument maneuvers. Also, more sensitive airspeed and "rate of climb" indicators increased the precision capacity of instrument flying.

With the advent of the "full panel" of flight instrumentation, the Needle-Ball-Airspeed system of control was changed. For fully coordinated flight, the pilot simultaneously had to center the needle with the aileron and center the ball with rudder pressure.

ATTITUDE INSTRUMENT FLYING

In spite of the numerous technical advances toward an all-weather capability, instrument flying was very limited. At the time of entry into World War II, the

DES welcomes your inquiries and requests to focus attention on an area of major importance. Write to us at: Commander, U.S. Army Aviation Center, ATTN: ATZQ-ES, Ft. Rucker, AL 36362; or call us at AUTOVON 558-3504 or commercial 205-255-3504. After duty hours call Ft. Rucker Hot Line, AUTOVON 558-6487 or 205-255-6487 and leave a message

average pilot had a very scant knowledge of the art of instrument flying. As late as 1943 the Needle-Ball-Airspeed system of instrument flying was still being taught in some military flying schools. Flying cadets often were advised to "cage" the artificial horizon and fly with needle, ball and airspeed if weather conditions were encountered.

Full use of available flight instruments was not achieved until introduction of a method of aircraft control called "attitude instrument flying." This method taught the pilot to make precise attitude changes on the attitude indicator and power adjustments as required to achieve desired performance.

Aircraft performance is achieved by controlling the aircraft attitude and power (angle of attack and thrust/drag relationship). Aircraft attitude is the relationship of the longitudinal and lateral axes to the earth's horizon. An aircraft is flown in instrument flight by controlling the attitude and with power as necessary to produce the desired performance. This is known as the "control and performance concept" of attitude instrument flying and can be applied to any basic instrument maneuver.

This article discusses the procedures and techniques used in the Control and Performance Concept of attitude instrument flying.

Control Instruments display attitude and power indications and are calibrated to permit attitude and power adjustments in definite amounts.

Performance Instruments indicate the aircraft's actual performance. Performance is determined by reference to the altimeter, airspeed indicator, vertical velocity indicator, heading indicator, and turn-and-slip indicator. These instruments indicate the aircraft performance regardless of whether the pilot is referring to the earth's horizon, the attitude indicator, or both, to control the aircraft attitude.

Navigation Instruments indicate the position of the aircraft in relation to a selected navigational facility. This group of instruments includes radio magnetic indicator, VOR indicator, localizer course indicator, glide slope indicator and marker beacon indicator. Since this article is concerned with basic aircraft control and not with the aircraft position over the ground, navigation instruments are not discussed.

CONTROL AND PERFORMANCE CONCEPTS

Attitude Power Control. Proper control of aircraft attitude is the result of maintaining a constant attitude, knowing when and how much to change the attitude, and smoothly changing the attitude a definite amount. Aircraft attitude control is accomplished by proper use of the attitude indicator. The attitude indicator provides an immediate, direct and corresponding indication of any change in aircraft pitch or bank attitude. In addition, by means of the attitude indicator, small pitch and bank changes are easily seen and changes can be readily accomplished.

Pitch Control. Pitch changes are accomplished by changing the "pitch attitude" of the minature aircraft or fuselage dot definite amounts in relation to the horizon bar. These changes are referred to as bar widths or fractions thereof, or degrees depending upon the type of attitude indicator. A bar width is about 2 degrees on most attitude indicators. The amount of deviation from the desired performance will determine the magnitude of the correction necessary.

Bank Control. Bank changes are accomplished by changing the "bank attitude" or bank pointer(s) definite amounts in relation to the bank scale. Usually, the bank scale is graduated at 0, 30, 60 and 90 degrees and is located at the top of the attitude indicator. Normally an angle of bank which approximates the degrees to be turned, not to exceed 30 degrees, is used in instrument flight. True airspeed and the desired rate of turn are factors to consider.

Power Control. Proper power control results from the ability to smoothly establish or maintain desired airspeeds in coordination with attitude control changes. Power changes are accomplished by throttle(s) adjustment and reference to the manifold pressure gauges and tachometers. Power indications are not affected by such factors as turbulence, improper trim or inadvertent control pressures. Therefore, little attention is required to ensure that the power indication remains constant, once it is established.

Trim Technique. The aircraft is correctly trimmed when it is maintaining a desired attitude with all control pressures neutralized. Proper trim technique is essential for smooth and precise aircraft control during all phases of flight. By relieving all control pressures, the pilot will find that it is much easier to hold a given attitude constant. Also, more attention can be devoted to the navigation instruments and additional cockpit duties.

Cross-Check Technique. The control and performance concept of attitude instrument flying requires the pilot to establish an aircraft attitude power setting on the control instruments which should result in the desired aircraft performance. Therefore, the pilot must be able to recognize when a change in attitude power is required. By cross-checking the instruments properly the pilot can determine the magnitude and direction of adjustment required to achieve the desired performance.

Cross-checking is the proper division of attention and interpretation of the flight instruments. Attention must be efficiently divided between the control and performance instruments in a sequence that ensures comprehensive coverage of the flight instruments.

Looking at each of the instruments at the right time is of no value unless the pilot interprets what he sees. Therefore, proper division of attention and interpretation are the two essential parts of a cross-check.

Factors Influencing Instrument Cross-Checks. A factor influencing cross-check technique is the characteristic manner in which instruments respond to changes of attitude or power. The control instruments provide direct and immediate indications of attitude or power changes. Changes in the indications on the performance instruments will lag slightly behind changes of attitude or power. This lag is due to inertia of the aircraft and the operating principles and mechanisms of the performance instruments. Therefore, some lag must be accepted as an inherent factor. This factor will not appreciably affect the tolerances within which the pilot controls the aircraft; however, at times a slight unavoidable delay in knowing the results of attitude or power changes will occur.

Lag in the performance instruments should not interfere with maintaining or smoothly changing the attitude or power indications. When the attitude and power are properly controlled, the lag factor is negligible and the indications on the performance instruments will stabilize or change smoothly. The pilot must not be lured into making a flight control movement in direct response to the lag in the indications on the performance instruments without first referring to the control instruments. If permitted, such action invariably leads to erratic aircraft control and will cause additional fluctuations and lag in the performance instruments. Sufficient reference to the control instruments will minimize the effect of lag on the performance instruments, nullify the tendency to "chase" performance instrument indications and result in smooth aircraft control.

Another factor influencing cross-check technique is the location of the flight instruments. In some aircraft the flight instruments are scattered over a wide area of the instrument panel. The pilot is unable to bring several instruments into his cross-check at the same time. He must rapidly scan each instrument individually back and forth across the instrument panel.

An important factor influencing cross-check technique is the ability of the pilot. The pilot who interprets his instruments quickly and correctly does not have to refer back to them for information as often as the pilot who is slow to interpret. Also, he is able to bring several instruments into his cross-check with one glance, interpreting them simultaneously. Therefore, the speed with which he divides his attention does not have to be as rapid as the pilot with less ability, who must scan the instruments rapidly to stay ahead of the aircraft.

The attitude indicator is the only instrument which the pilot should observe continuously for any appreciable length of time. About 10 seconds may be needed to accomplish an attitude change required for a normal turn. During this 10-second period, the pilot may need to devote almost exclusive attention to the attitude indicator to ensure good attitude control. The attitude indicator is also the instrument that should be observed the greatest number of times. This is shown by the following description of a normal cross-check. A pilot glances from the attitude indicator to a performance instrument; back to the attitude indicator, then a glance at another performance instrument; back to the attitude indicator; and so forth. This cross-check technique can be compared to a wagon wheel. The hub represents the attitude indicator and the spokes represent the performance instruments.

This example of a normal cross-check does not mean that it is the only method of cross-checking. Often a pilot must compare the indications of one performance instrument against another before knowing when or how much to adjust the attitude power. An effective cross-check technique may require that attention to the attitude indicator be inserted between glances at the performance instruments being compared. Preponderance of attention to the attitude indicator is normal and desirable to keep the fluctuations and lag indications of the performance instruments to a minimum. This technique permits the pilot to read any one performance instrument during a split-second glance and results in smooth and precise aircraft control.

A proper and relative amount of attention must be given to each performance instrument. Pilots seldom fail to observe the one performance instrument whose indication is most important. The reverse is a common error. Pilots frequently devote so much attention to one performance instrument that the others are omitted from the cross-check. Also, they often fail to cross-check the attitude indicator for proper aircraft control.

Cross-Check Analysis. A correct or incorrect cross-check can be recognized by analyzing certain symptoms of aircraft control. Symptoms of insufficient reference to the control instruments are readily apparent. If the pilot does not have some definite attitude and power indications in mind that should be maintained or established and the other instruments fluctuate erratically through the desired indications, then the pilot is not referring sufficiently to the control instruments. This is usually accompanied by a lack of precise aircraft control (chasing the indications) and feelings of ineffectiveness and insecurity by the pilot.

Sufficient reference to the attitude indicator can be determined easily. If the pilot has in mind definite pitch and bank attitudes to be used and employs them properly, he is using the attitude indicator sufficiently.

Except for fixation on the power indicators, the

problem of too much attention being devoted to the control instruments is rarely encountered. This is normally caused by the pilot's desire to maintain the performance indications within close tolerances. Too much attention to the control instruments can be recognized by the following symptoms. If the pilot has a smooth, positive and continuous control over the indications of the control instruments but large deviations are observed to occur slowly on the performance instruments, a closer cross-check of the performance instruments is required.

An incorrect cross-check can result in the omission of or insufficient reference to one or more instruments during the scanning process. Pilots are inclined to omit some performance instrument(s) from the cross-check, although other performance instruments and the control instruments are being observed properly. For example, during a climb or descent, a pilot may become so engrossed with pitch attitude control that he fails to observe an error in aircraft heading.

RULES OF THUMB

Maintaining A Desired Altitude. NOTE: Fluctuations of the vertical velocity indicator are common and are not to be considered as trends. Sustained deflection of the vertical velocity indicator is a trend and will be indicated on two additional performance instruments, the airspeed indicator and the altimeter. A technique for predetermining the vertical velocity for a given pitch change is directly related to the true airspeed. One degree (½ bar width) of pitch change will result in an approximate vertical velocity that is equivalent to miles per minute times 100. Example: 180 knots or 3 nautical miles/minute × 100 × 1 degree = 300 feet/minute.

When a deviation from the desired altitude occurs, the pitch attitude change on the attitude indicator should produce a rate of vertical velocity about twice the size of the altitude deviation. Example: 100 feet altitude deviation use 200/minute rate of climb or descent.

As a suitable lead point on the altimeter to prevent "overshooting," use 10 percent of the vertical velocity. Example: 300 feet/minute vertical velocity, initiate the level off 30 feet before reaching the desired altitude.

Maintaining A Desired Heading. Maintaining a desired heading is accomplished by maintaining a zero bank attitude in coordinated flight. The control instrument (attitude indicator) is kept at zero bank and the two performance instruments as follows: turn-and-slip indicator centered, heading indicator static.

Deviations: When small deviations from the desired heading occur, refer to the attitude indicator and smoothly establish a definite angle of bank which will produce a suitable rate of return. As a guide, the angle of bank on the attitude indicator should equal the heading deviation in degrees. For example, if the heading deviation is 10 degrees, use a 10-degree angle of bank on the attitude indicator.

Turns (Bank Control). Before entering a turn, the pilot should decide upon the angle of bank to be used. Factors to consider are true airspeed and the desired rate of turn. A slow rate of turn may unnecessarily prolong the turn, whereas a high rate of turn may cause overshooting of the heading and difficulty with pitch control.

The angle of bank for a standard rate turn is directly related to the true airspeed. A technique used to predetermine the angle of bank for a standard rate turn is as follows: true airspeed in knots divided by 10 plus 7 equals angle of bank (130 knots ÷ 10 + 7 = 20 degrees) for a standard rate turn.

Adjusting Attitude And Power. As previously stated, the control and performance concept of attitude instrument flying requires the adjustment of aircraft attitude and power to achieve the desired performance. A change of aircraft attitude or power is required when any indication other than that desired is observed on the performance instruments. However, it is equally important for the pilot to know what to change and how much pitch, bank or power change is required.

- *What To Change.* The pilot knows what to change by understanding which control instrument to adjust to achieve the desired indications on the performance instruments. Pitch attitude control is used primarily to maintain an altitude or to control the rate of climb or descent. Pitch attitude control may be used to maintain airspeed during maneuvers requiring a fixed power setting. Bank attitude control is used to maintain a heading or a desired angle of bank during turns. Power control is used for maintaining or changing the airspeed except for maneuvers using a fixed power setting.

- *How Much To Change.* How much to adjust the attitude or power initially is an estimate based on familiarity with the aircraft and the amount the pilot desires to change the indications on the performance instruments. After making a change of attitude power, he should observe the performance instruments to see if the desired change occurred. If not, further adjustment of attitude power is required.

Instrument flying is a continuous process of maintaining aircraft attitude; adjusting power settings based on the control instrument(s); trimming the aircraft; cross-checking the performance instruments; and based on instrument interpretation making adjustments as necessary. This applies to any basic instrument maneuver and should result in more precise instrument flying.

This month's article by Ronald R. Simmons completes his series started in July. The *Aviation Digest* has been privileged to present these to its readers because their messages about visual workload during flight are of vital interest to Army Aviation personnel.

Mr. Simmons is a research psychologist with the U.S. Army Aeromedical Research Laboratory (USAARL) at Ft. Rucker, AL, a position he has held since 1974. He is an Army aviator, having been graduated from flight school in 1967. He flew 4 years on active duty and has since been in the Army Reserve.

His civilian education includes a master's degree in psychology from Troy State University.

Co-author on the current article is Joan Blackwell, a graduate student from Jacksonville (AL) State University. She is working at USAARL as a psychology technician on visual performance studies under a cooperative education assignment to give her experience in her career field.

DOWN 'N DIRTY

Ronald R. Simmons and Joan Blackwell

STRAP YOURSELF into the pilot seat of a UH-1 Huey helicopter. Crank the helicopter and start toward the forward edge of the battle area, using the Army's best nap-of-the-earth (NOE) techniques (figure 1, page 39). You are over unfamiliar terrain. You are now in one of the most demanding and least forgiving flight profiles invented. The term "busy pilot" now has meaning for you. You are it.

NOE requires the helicopter to be flown so close to the earth that a major task for the pilot is to remain airborne and to avoid hitting any obstacles. Since you are flying a UH-1 helicopter, be comforted by the fact that the copilot is relieving you of navigation workload. However, because only a hand-held map is used to navigate, the copilot/navigator is also busy.

Suppose instead of a UH-1 helicopter you climbed into an OH-58A or OH-58C scout helicopter (figure 2, page 39). As the pilot of the scout helicopter you are, in theory, now in command of a single-pilot aircraft and you're expected to both fly and navigate. That *is* high workload!

You ask, what is high workload? Well, it is obvious that no more physical strength is required to manipulate the aircraft controls during NOE than during instrument flight rules (IFR) or normal visual flight rules (VFR). So, physical effort and fatigue are not the important considerations during NOE.

The important fact is that the proximity of the aircraft to the ground and obstacles during NOE places heavy visual demands on a

The opinions expressed in this article are those of the authors and do not necessarily reflect the views of the Department of Defense

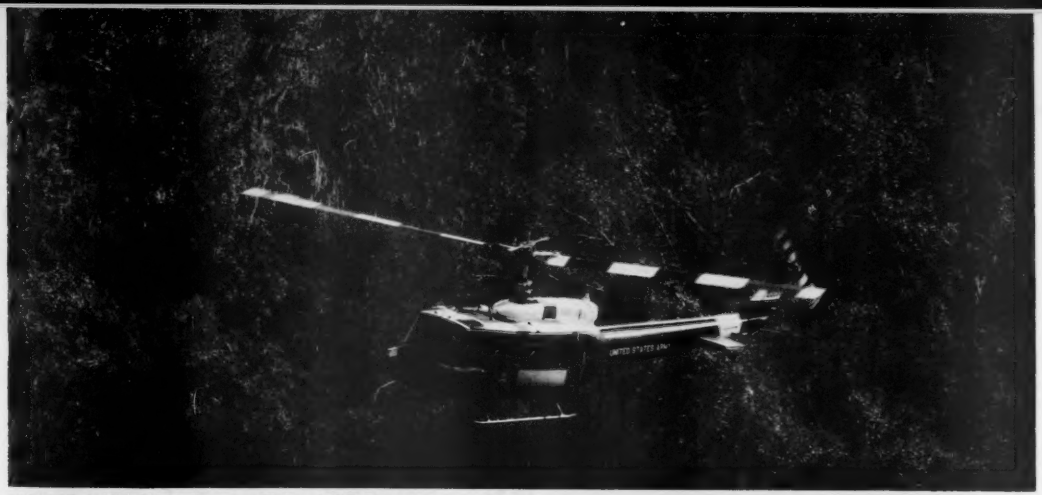


FIGURE 1: UH-1H Helicopter Flying NOE Course

FIGURE 2: OH-58C Helicopter Flying NOE Course

pilot. Here, a pilot not only keeps the aircraft airborne but also visually "clears" the aircraft to avoid hitting trees, wires or other obstructions. So, we are defining workload as the visual energy expended over time. The key to visual workload, therefore, is determining what should be scanned during the available time.

Obviously top priority should go to visually monitoring the necessary cues to remain airborne (attitude cues). Almost as important, however, is the act of searching for and monitoring any obstacles with which the aircraft might be on a collision course.

As a general rule, accurate completion of those two tasks leaves little or no time for other necessary work such as checking aircraft systems' status gauges, helping navigate or working the radio communications.

A pilot, flying at 2,000 or 3,000 feet under VFR, casually glances at the instruments and looks out the front window again. Even during IFR the pilot normally has more than sufficient time to scan all flight gauges as well as the aircraft status gauges. NOE flight on the other hand just doesn't offer the luxury of free time.

All available time becomes critical in regard to gaining visual information during NOE. "Pilot error" accidents occur when the pilot's visual capability is overextended due to tremendous visual requirements, inadequate visual cueing or some visual distraction.

A scout helicopter pilot attempting to fly the aircraft, avoid obstacles, navigate the NOE course and perhaps even work one or more radios, is a prime example of "visual overloading."

Penetration into inadvertent instrument meteorological conditions (IMC) while flying at NOE levels with slow airspeed is the most obvious example of inadequate visual cueing. In this situation normal recovery by transitioning to instrument flight is further complicated by the added degree of aircraft in-

FIGURE 3: Visual workload of pilot/copilot during NOE

Visual Workload	UH-1 Pilot	UH-1 Copilot	OH-58A Single Pilot	OH-58C Single Pilot
Percent Time Outside	80.90	56.50	62.30	61.40
Percent Time Inside	5.10	37.40	20.50	21.10
Percent Time Transition	14.02	6.10*	17.20	17.50
Eye Fixation Per Second	2.22	NA	1.82	1.88
Head Fixation Per Second	1.03	NA	1.37	1.29
—Breakdown of Percent Time Inside—				
Airspeed Indicator	2.50		2.40	1.80
Altimeter	2.00		1.50	1.70
Radio Magnetic Compass		0.80	0.80	0.70
Torque Gauge			1.00	0.80
Turn-and-Bank Indicator	0.20		0.30	0.30
Fuel Gauge	0.20			
Aircraft Status Gauges		1.70		
RPM Gauge	0.20		0.80	0.90
Map		34.90	13.70	14.90

*Value Approximate NA—Data Not Available

stability caused by the slow airspeeds and less forgiving altitude.

Imagine an accident caused by a master caution light attracting the pilot's attention at the low NOE altitude. The pilot's visual attention is diverted from maintaining proper obstacle clearance, increasing the probability of contact with trees, wires or other barriers. In this situation, an accident results because of visual distraction.

You think what has been discussed to this point is "one person's opinion"? Survey past accident reports and you will see samples of "pilot overextensions" presented as blade strikes, IMC accidents and other near-to-fatal accidents.

The visual workload and activity profiles of an average pilot during NOE have been developed by the U.S. Army Aeromedical Research Laboratory (USAARL) at Ft. Rucker, AL. Extensive research programs were created to establish the visual workload of Army aircrews during nap-of-the-earth operations and actual visual data were collected in several phases using techniques presented in July's issue of the *Aviation Digest* (see pages 21 to 23 of that issue). During three separate phases, five fully qualified Army aviators flew as "pilot in command" of a UH-1H, OH-58A and OH-58C helicopter. Additionally, five pilots served as copilots/navigators of the UH-1H helicopter. Visual performance workload was objectively measured and recorded, and the results of those four studies are summarized in figure 3. The pilots' visual activities are denoted as percentages of time looking outside and inside the aircraft, as the percentage of time the eyes were moving (transition), and as the number of eye and head fixations per second. Time spent looking inside the aircraft is reflected in the lower section of the figure.

Figure 3 shows that the visual time spent outside the aircraft is in excess of three times that inside. Based on the flying and navigating figures of time allocation in the dual-pilot UH-1, one aviator performing both tasks in the OH-58C would spend 80.9 percent of the time looking outside, 34.9 percent reading the map and, conservatively, 20 percent looking at the instrument panel. (That's 35.8 percent more time than the pilot has available.)

Of course, the OH-58 scout pilot could not perform under this overload condition and something had to give. Nine out of the 10 OH-58 scout pilots failed to successfully navigate the assigned NOE course. Given the tasks of remaining airborne, avoiding obstacles and navigating a course, the scout pilots prioritized their time appropriately. They were lost but had no incidents or accidents.

Breakdown of the visual workload inside the aircraft showed that only the copilot of the UH-1H used any available time to monitor the aircraft's status gauges. Torque and rpm gauges were checked more often in the OH-58 helicopter. The airspeed indicator was the most closely watched of the flight displays, with the turn-and-bank indicator being referenced occasionally. Finally, as mentioned earlier, using a hand-held map was a major workload requirement, with the copilots in the UH-1H checking their maps over two times more than did the pilots in either scout helicopter. (As an added note of interest, 100 percent of the UH-1 courses were flown successfully.)

The moral of this story is obvious. Nap-of-the-earth flight is demanding. Visual overload, insufficient visual cueing or visual distraction can be catastrophic. Single-pilot NOE missions are launched with the pilot close to being overextended and as the mission continues, things get progressively worse.

It is important to point out that night NOE, even while using night vision goggles (NVG), is extremely hazardous. Studies have revealed that pilots under normal night operations rely heavily on aircraft flight displays for supportive information to the restricted outside cues. Pilots' visual transition from outside to inside the aircraft is difficult with NVG. Based on this perceived problem USAARL has, over the past 2 years, researched the feasibility of displaying critical aircraft information on the lens of the night vision goggles.

One can quickly see that during day or night when one is flying "down 'n dirty" there is little room for error.

CW2 Michael E. Little
CW2 Little was assigned to the Directorate of Training and Doctrine, U.S. Army Aviation Center, Fort Rucker, AL when he wrote this article.

UH-60 TRAINING AT THE U.S. ARMY AVIATION CENTER

SO YOU'VE BEEN told that you are going to receive a UH-60A Black Hawk transition. *Great!* But now you're wondering what you can expect when you come to the U.S. Army Aviation Center at Ft. Rucker, AL, for your transition. The following article will give you some insight into the program.

When pilots come to Ft. Rucker for this transition, they can expect to stay for about 3½ weeks. The first week is spent entirely in the classroom receiving a basic introduction to the aircraft and a thorough explanation of its subsystems. After a week of academics, the pilots will spend half of their working days on the flight line and the other half in academics. While at the flight line, they receive 15 hours of flight instruction divided into the following categories:

- **Contact:** 10.9 hours of tactics training, of which 5.3 hours is familiarization only (Doppler oriented) and 1.3 hours is night training.
- **Instruments**: 2.6 hours, including tactical instruments.
- **Evaluation**: 1.5 hours.
- **Total**: 15.0 hours.

The goal in both the academic training and that received on the flight line is to impart an understanding of systems' operations and why they behave as they do. The focus is on the system as a whole instead of the individual parts. This assists the aviators in determining whether a particular system is functioning properly without memorizing the specific details or characteristics that would denote a failure or degradation in the system.

For example, the hydraulics system in the UH-60A employs, as a principal element, a logic module capable of isolating and controlling leaks, and which to some extent prevents loss of one or more of the hydraulic pumps or systems. How-

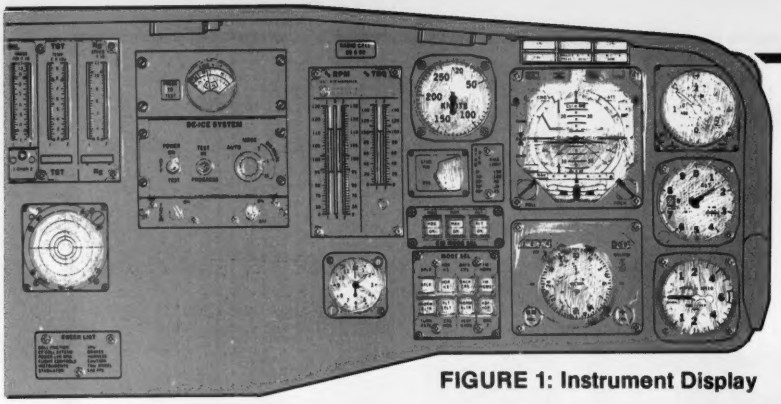


FIGURE 1: Instrument Display

ever, since pilot action is still required in some circumstances, the pilot must have a thorough understanding of the hydraulic system.

To teach this systems approach and provide the pilots with a good overall understanding of this aircraft, some new equipment has been purchased. By the time this article is published, the academic section will be using new computer-assisted training boards that display the functioning components of all the major aircraft systems. For example, one of the boards displays all of the major components of the electrical system. The instructor can simulate each part of the system and demonstrate all of the malfunctions an aviator could expect to encounter by visually displaying the current flow from the generators through the circuit breakers to the respective component.

In an effort to maximize each training dollar, the Army is evaluating two candidate UH-60A visual flight simulators for possible procurement and export to the field. The new simulators will be capable of generating a display that will allow the pilot to fly the simulator by visual or instrument cues. The simulator will incorporate one of two systems: a computer-generated imagery system whereby a computer senses the simulator's attitude, velocity and position in relation to the "earth" and it then displays a visual representation of what the pilot could expect to see in that condition; or a terrain board system that uses a miniature camera to follow the simulated aircraft's path.

For those who have not had the opportunity to see one of the displays, they could be described as looking like a large model train set, minus the train. They are complete with roads, hills, pastures, trees, lakes, houses, and other terrain and man-made features. Which system will be purchased has yet to be determined, and, as such, the simulator has not yet been included in the program of instruction. However, those attending Black Hawk transition courses between September 1980 and January 1981 receive a portion of their transition training in these simulators as a part of the evaluation process of the candidate simulators. When it is made available, the simulator will be a tremendous aid in practicing maneuvers that, because of the inherent risk, cannot be taught in the aircraft. No final determination has been made at this writing concerning how much time will be devoted to the simulator and to the aircraft.

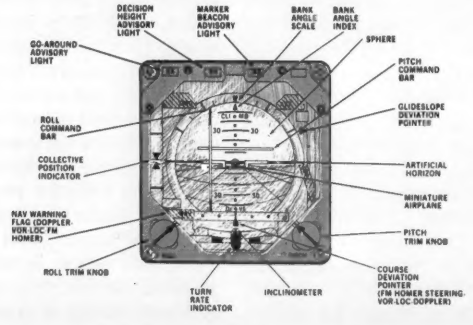
Flight-line instruction in the UH-60A consists of a basic introduction to the aircraft, a review of visual flight rules (VFR) and instrument flight rules (IFR) procedures used by all helicopter pilots and an explanation of and training in UH-60A unique procedures, systems and characteristics.

Initially, a review is conducted on how to calculate the performance capabilities of the aircraft. Since the UH-60A has two engines, pilots are shown how to calculate single engine performance and how to determine critical airspeeds and conditions.

Next it's off to the aircraft to learn how to perform a preflight inspection and proper cockpit and runup procedures. The flight training days that follow are devoted to instruction in the proper execution of basic helicopter maneuvers: hovering flight, taxiing, takeoffs, landing and normal VFR flight procedures. It is not so much that we teach people how to fly, but how to best accomplish these tasks in a UH-60A.

The Black Hawk has an automatic flight control system (AFCS) and is designed to reduce the pilot's overall workload by greatly enhancing the stability of the helicopter. It does this by the use of a

FIGURE 2: Vertical Situation Indicator (VSI)



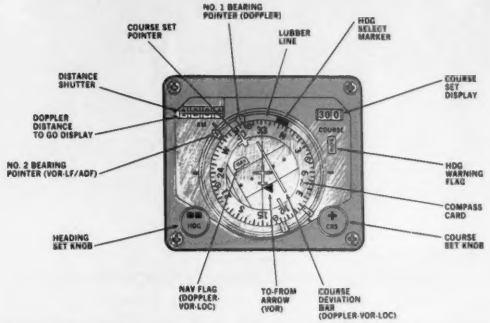


FIGURE 3: Horizontal Situation Indicator (HSI)

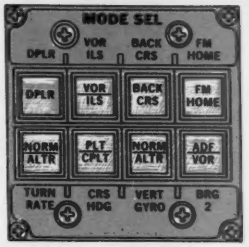


FIGURE 4: HSI/VSI Mode Selector

FIGURE 5: CIS Mode Selector

stabilator, the large movable wing under the tail rotor, two stability augmentation systems, and a flight path stabilization computer. To the pilots this means that in order to make maximum use of the AFCS, they should know what the AFCS is, what subsystems it contains and what it is supposed to do.

Learning to fly the aircraft leans more toward learning to let the aircraft do what it was designed to do and how to manipulate the controls for various modes of flight. Some of the maneuvers taught are the procedures for landing if one engine fails and the other is not capable of maintaining flight; how the aircraft flies with all or part of the AFCS disabled; and what to do in the event of an engine fire in flight.

Along with the contact training, the pilots are given a review of instrument procedures. Flight planning, weather requirements and instrument flight rules are briefly reviewed for the benefit of those who have not had the opportunity to perform IFR operations recently. During the instrument training phase, the pilots are acquainted with the new instrument display (figure 1) and the procedures necessary to operate it as well as the command instrument system (CIS). The latter is commonly referred to in the civilian sector as a flight director.

Briefly, the instrument system allows the pilot or copilot to display on the vertical situation indicator (VSI) (figure 2) and the horizontal situation indicator (HSI) (figure 3) course information from any of the modes on the upper row of the HSI/VSI mode select panel (figure 4). The instruments and CIS show pilots their vertical and horizontal situation with respect to the mode selected.

The CIS does not control the helicopter directly as does an autopilot, but it does provide pilots with attitude and navigation information and computed vertical and lateral steering commands, enabling them to accurately control the helicopter during VFR and IFR operations. These command bars are displayed on the VSI and are engaged by pressing the appropriate CIS mode on the CIS mode select panel (figure 5) for the procedures being flown. Pilots are shown the CIS capabilities, limitations and how and when to properly use the system. During the instrument phase the pilots perform ADF, VOR, LOC, ILS and GCA approaches, both with and without the CIS.

The new instrument display used in the UH-60A has been praised by all who have used it even though it takes a little time to learn what information is desired and how to set up the display.

Throughout the course each aviator receives an orientation about UH-60A capabilities in a tactical environment. During this orientation, emphasis is placed on the principal navigational aid, the Doppler. Programing, updating and navigating with the set are stressed in all modes of terrain flight. Load operations, as well as tactical instruments, also are incorporated into normal mission planning. A night flight rounds out the overall capabilities. Principal points covered are night formation flight, external loads, instruments and emergencies to include roll-on landings.

In general, this is what pilots can expect when they come to Ft. Rucker for a UH-60A transition. The pace is rapid and the workload is heavy. Much work has been put into the development and operation of the course, and a fair amount of effort is expected in return. Hope to see you soon.

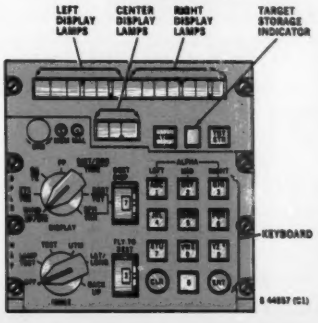


FIGURE 6: Doppler Navigation Set AN/ASN-128

A Hole In The Head Can Kill You

CW3 Lisle F. Pickard
U.S. Army Safety Center
Fort Rucker, AL

IT WAS A routine flight for the experienced CH-47 crew, dropping parachutists at altitudes of 7,000, 10,000 and 13,000 feet.

The weather was perfect, all the drops were made without incident and everything was fine—until the final descent when the pilot screamed, grabbed his head and then lost consciousness.

The aircraft was landed safely by the copilot in that case, but what would have happened if it had been a single pilot helicopter?

I was the nonfunctioning aviator and that incident which happened about 4 years ago in Germany made me vitally aware of the need to search out and eliminate any reason which could cause such incapacitation.

On that day we had made several ascents and descents to the different altitudes. I felt extremely good and was thoroughly enjoying the mission. I knew I was in excellent physical condition because I was not a smoker, I was well rested and I maintained a balanced diet. No problems were anticipated.

After the last drop of the parachutists I established a descent of between 1,500 and 2,000 feet per minute, going so rapidly in order to avoid a developing cloud condition. After getting started, I turned the controls over to the copilot, leaving me free to establish radio contact with our destination airfield.

There was no warning before the pain hit suddenly and with tremendous intensity. All I remember is holding my head and screaming.

When I came to, we were on the ground and shutdown procedures were being completed.

I was immediately taken to a dentist where an emergency root canal was done and where I learned I had been flying with an infected tooth and sinus and was the victim of something called barodontalgia, barosinusitis and dysbarism.

Barodontalgia is pain associated with the teeth due to poor dental health or recent dental restoration as affected by barometric pressure changes. Barosinusitis is an inflammation where pain is associated with the sinuses normally due to infection or congestion and is affected by barometric pressure changes. And trapped gas dysbarism is a syndrome consisting of those disturbances in the body resulting from the existence of a pressure differential between the total ambient barometric pressure and the total pressure of the free gases within the body.

The culprit in my case was a small cavity in one of my upper molars, caused by a filling which had come out about a week before. I had fully intended to have it repaired as soon as I could; but it didn't cause any discomfort, so I wasn't too concerned about it.

Anyway, as the doctor explained to me: The trapped gases from the tooth and sinus infections, which were not bad enough for me to even be aware of them, escaped through that small hole in my tooth during our normal ascents/descents.

During the rapid rate of descent after the last drop, however, the pressure equalization could not occur through the same cavity. That resulted in a partial vacuum and a large amount of negative pressure on the infected nerves. Whamo—pain like I could not believe!

How could I have avoided what happened? Obviously, I should have had the tooth repaired when the filling came out. That would doubtlessly have stopped the trouble with the tooth as well as the sinus, since the roots of the upper premolars and molars are in close proximity to the floor of the maxillary sinus and occasionally protrude through the bone into the sinus itself.

My terrible pain, loss of consciousness and the very real possibility of an aircraft crash stemmed from my good intentions which were not fulfilled!

In Army Aviation we normally think of incapacitation for a crewmember as being caused by something major like heart attack or lack of oxygen. What we have to be aware of, though, is that anything out of the ordinary with any part of our body or its functions might cause a partial or complete loss of the ability to function.

The incapacitation I sustained 4 years ago was caused by a real hole in the head. I have vowed not to have another loss like that from such a reason, either literally or figuratively.

BEATING THE HIND-D

The ***Aviation Digest*** *thanks* ***Defence Attache*** *for permission to reprint this article*

DURING THE recent past, several articles have appeared in various military publications exhorting the threat which the Soviet attack helicopter, Mi-24 HIND, represents to Army tactical aviation.

Most articles to date have focused on the aircraft itself and how it may be employed on future battlefields. The following article, which appeared in a British publication, provides some insight as to how the HIND may be countered—particularly in a Central European scenario. It is interesting to note that the author contends that the most viable antihelicopter weapon may be an unsophisticated, short-range, air-to-air missile rather than a common antitank guided missile or rocket. Today, several U.S. weapon systems may be compatible in an air-to-air role. Among these are the Multipurpose Lightweight Missile System (modified STINGER), modified air-to-air missiles and of course, cannon or Gatling guns.

Regardless of the recommended antihelicopter weapon, "Beating the HIND-D" stands as evidence that the HIND has created as much interest and controversy among our allied NATO friends as has occurred within our Army. The threat of the HIND is not diminishing, rather it increases as we learn more about the aircraft's capabilities and combat employment.

Threat Section
Directorate of Combat Developments
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Fort Rucker, AL

SENIOR NATO officers have become increasingly alarmed by the threat posed by the ever-growing number of helicopters deployed in the Group of Soviet Forces in Germany (GSFG). Over the last 10 years the strength of troop-carrying machines such as the Mi-8 HIP and Mi-6 HOOK has more than quadrupled. Of even more concern are the very large numbers of Mi-24 HIND-D gunships also in GSFG—a most formidable weapons system with its combination of cannon, rockets, bombs and antitank missiles. The threat posed by such a large force is formidable, be it employed at divisional, army or front level, and there can now be little doubt that it is directed at one of NATO's most vulnerable points, the Corps rear areas of the Central Region.

In a period of tension, under the NATO alert system the Corps of the Northern and Central Army Groups (NORTHAG/CENTAG) will deploy towards the Inner German Border (IGB) and take up a continuous defensive position. The strength of this defensive line will to a large part depend on the ability of the Allies to reinforce the forces in being, but there is little doubt

that such a well-prepared position would be a hard nut to crack by frontal assault. As the general line of the position has over the years moved forward toward the IGB, the depth of the areas to the rear has increased accordingly. The whole now could be likened to a "thin red line" or crust over the front with precious few troops spread over the large areas behind it. It is within the extensive and thinly-held rear areas that one finds the large headquarters and vital logistic installations which present such an inviting target to a heliborne force.

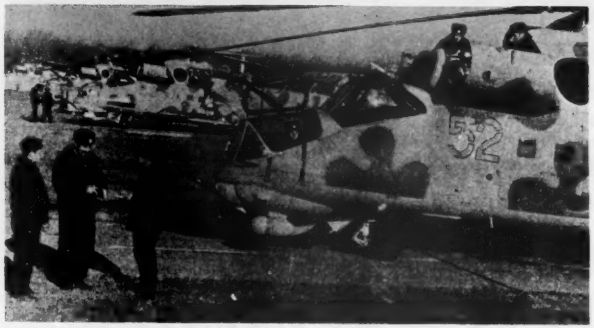
It is considered that a force of HIP and HOOK helicopters carrying Motor Rifle troops and supported by HIND-D gunships could be sent to overfly the main defensive positions. Certainly it would suffer considerable losses from the increasing number of field air defence weapons, but nonetheless it is believed that a sizeable and dangerous proportion would get through. Apart from attacking important rear targets, the force would be in an ideal position to create havoc to the main supply arteries of the field formations.

So much for the threat; we must now examine ways of countering it. Such measures as increasing the number of air defence weapons and the number of troops in the rear areas would help, but within current NATO manpower ceilings are not feasible. Furthermore, such remedies suffer the major disadvantage of a lack of mobility in countering a highly mobile threat. Troops and air defense weapons would inevitably be in the wrong position and unable to react quickly enough before the damage was done.

One is drawn to the conclusion that the answer lies in the air. The NATO tactical air forces 2 ATAF and 4 ATAF already have far too many conventional commitments for their numbers, quite apart from nuclear roles. They have therefore to allot priorities and for the foreseeable future these must remain as the counter-air battle, air interdiction and tactical support of the main defensive battle. In any case, the modern fighter is not well suited to counter fast, low flying helicopters. Remaining options centre around close support aircraft of the A-10 type, and helicopter fleets. The A-10 is faster than Soviet helicopters, is highly manoeuvrable and, with its 30 mm GAU-8 Gatling gun and other weapons, enjoys formidable firepower. Such a system would seem ideal. It is a capability that would be held in reserve, alerted to meet the threat by early warning radar or Army forward observers and scrambled to meet the enemy either in the air or to engage it in and around the helicopter landing sites. However, it is unlikely that the USAF A-10 wings will have any aircraft to spare from their prime antiarmour role. The other Allies in the Central Region do not have such a system and nor would they have the resources to acquire or deploy one. It is known that a feasibility study has been carried out by British Aerospace (Dynamics Division rather than the aircraft side, as the purpose was to explore the desired characteristics of a platform suitable to carry an air-launched version of the Rapier surface-to-air missile) and is understood to have come up with a light fixed wing aircraft powered by a pusher turboprop giving a combat speed of about 250 knots. Whatever the merits of such a design, the cost of development and procurement would clearly be prohibitive.

The answer may lie with the light helicopter fleets of the Central Region. In the main, they have two major war roles, action against armour with antitank guided weapons, and reconnaissance. Those dedicated to the antiarmour task should not be loaded with other commitments; they are relatively few and too vital for the ground battle. A so-called cheap solution, that helicopters fitted with ATGWs [antitank guided weapons] such at HOT and TOW could engage troop-carrying and gunship helicopters must be nonsensical, probably even within the original context of self-defense. Both the weapons mentioned have too short a range—maximum 4 km—and significantly long time of flight (12 seconds in the case of TOW at maximum range). It is therefore to the light helicopters currently broadly tasked to reconnaissance and liaison flights (Gazelle in the case of the British Army) that we should look to provide a weapons platform.

Most if not all of the helicopters required would have to come from those which field commanders are prepared to release. It can be argued that once the Allies have begun the aggressive delaying battle in their main defensive positions, helicopters will be too vulnerable as information-gatherers and unit commanders will have to rely on armoured reconnaissance vehicles for battlefield intelligence. A proportion of the reconnaissance helicopter fleet would then be available to be withdrawn to the rear and armed with antihelicopter weapons. The precise moment when this should be sanctioned would be a matter of fine judgment by senior commanders, and moreover it is not reasonable to expect the role-switch to succeed without a high degree of preparation, probably including the prior installation of sighting and guidance systems and launch rails/pylons for the selected weapon on those heli-



Mi-24 HIND-D Soviet Attack Helicopter

copters which it is considered will not be required to operate as target information gatherers with the ATGW squadrons or in the forward air controller or artillery spotter role. Possibly, some of the role-revised helicopters could be returned to the front and allocated to the protection of antitank helicopters from the attentions of HIND-D. It is also possible that resources will permit the establishment of a small standing force permanently fitted for the anti-helicopter role and held in the rear to meet the threat postulated by some observers, but still judged remote by others, of a sudden heliborne assault mounted as the opening throw of an enemy offensive. There would probably be too few to mount an effective defence, but nonetheless possibly enough to affect enemy planning. The standing force would also be useful in the tactical training of aircrew whose missions would be expected to change with the onset of hostilities. Questions such as these, and many others, cannot adequately be discussed within the confines of a short article.

What weapon should be adopted? The helicopter is a notoriously unstable platform, although stabilisation has helped to overcome this defect in modern machines. It is considered that machineguns and cannon are too limited in range, while unguided rockets are too inaccurate. There remains the missile. Ideally, what is required is a light (maximum 35 kg) air-to-air missile with a range of 5-6 km. None exists at present. Missiles such as the ALM-9L Sidewinder and Matra R550 Magic are considered too heavy for the Gazelle and the Bo-105. In the United States, Rockwell is studying a missile to meet the requirement, and Vought is also understood to be tackling the problem. In Britain, Shorts and British Aerospace Dynamics Division are investigating whether their Blowpipe and Rapier missiles could be successfully adapted, though Rapier is probably too heavy both in the weight of the missile itself and the associated equipment that would have to be carried inside the helicopter. Blowpipe is well within the desired weight, but at present has insufficient range. Whichever missile is selected, at least four should be mounted. The question of guidance is important, but difficult to determine at this stage or to discuss in a limited space. Terminal guidance missiles are particularly vulnerable to countermeasures and are unselective (two additional reasons for rejecting Sidewinder and Matra R550). Command to the line of sight guidance (CLOS) is probably the answer.

The weapon platform, and the manpower to fly and service it, are both already there. What is now required is the development of a suitable weapon. The need is urgent. The British MoD is currently conducting a feasibility study, and it is understood that a General Staff Requirement will be issued next year. Many consider it important that the system should be in service by 1984 at the latest.

U.S. Army Communications Command

ATC ACTION LINE

VIOLATIONS OF FAA REGULATIONS BY ARMY PERSONNEL

SO WHAT IF I violate the FARs, FAA can't do anything about it!"

Wrong! Army aviators are subject to the Federal Aviation Regulations (FARs) just as any other pilot. The extent of any action taken against an Army aviator who violates the FARs depends on the circumstances and recommendations made in the investigation of the violation.

The following paragraphs of FAR 13, Enforcement Procedures, are reprinted for your information:

13.21 MILITARY AIRCRAFT.

If a report made under this Part indicates that, while performing his official duties, a member of the armed forces, or a civilian employee of the Department of Defense who is subject to the Uniform Code of Military Justice (10 U.S.C. Ch. 47) has violated the Federal Aviation Act of 1958, or a regulation or order issued under it, the Chief Counsel, the Assistant Chief Counsel for Regulations and Enforcement, or the Regional Counsel concerned sends a copy of the report to the appropriate military authority for such disciplinary action as that authority considers appropriate and a report to the Administrator thereon.

13.23 CRIMINAL PENALTIES.

(A) Sections 902 and 1203 of the Federal Aviation Act of 1958 (49 U.S.C. 1472 and 1523), provide criminal penalties for any person who knowingly and willfully violates specified provisions of that Act or any regulation or order issued under those provisions. Section 110(b) of the Hazardous Materials Transportation Act (49 U.S.C. 1809(b)) provides for a criminal penalty of a fine of not more than $25,000, imprisonment for not more than five years, or both, for any person who willfully violates a provision of that Act or a regulation or order issued under it.

(B) If an inspector or other employee of the FAA becomes aware of a possible violation of any criminal provision of the Federal Aviation Act of 1958 (except a violation of 902(i) through (m) which is reported directly to the Federal Bureau of Investigation), or of the Hazardous Materials Transportation Act, relating to the transportation or shipment by air of hazardous materials, he shall report it to the Office of the Chief Counsel or the Regional Counsel concerned. If appropriate, that office refers the report to the Department of Justice for criminal prosecution of the offender. If such an inspector or other employee becomes aware of a possible violation of a Federal statute that is within the investigatory jurisdiction of another Federal agency, he shall immediately report it to that agency according to standard FAA practices.

The Administrator of the Federal Aviation Administration is emphasizing the enforcement aspect of the violation of FARs. This emphasis is beginning to show up in Army channels as a more formal investigation and notification of reported violations by Army pilots. Incidents that trigger the new automated conflict alert systems in the air traffic control facilities seem to be particularly susceptible to formal investigations. While the military services are responsible for appropriate disciplinary action of their pilots, the FAA is entitled by law (FAR 13.21) to a report of action taken.

What should I do if I violate an FAR? First of all, notify your immediate commander. The Department of Army Regional Representative (DARR) for the geographical area in which the violation occurred also should be notified immediately. Through his action any misunderstanding or inaccuracies may be corrected early in the investigation.

What Army regulations (ARs) cover violations of FARs? Paragraph 1-18, AR 95-1, refers commanders to ARs 95-5, 385-40 and 600-107. Several years ago there was a joint regulation, Army designation AR 95-12, entitled "Reporting and Investigating Alleged Violations of Flying Regulations." The U.S. Army Air Traffic Control Activity is in the process of preparing a new AR that will outline the procedure for processing FAR violations. In the interim, the DARR at the FAA Region or the Army Aeronautical Services Office, Cameron Station, Alexandria, VA 22314 will be glad to provide advice and assistance in the processing of violations.

Readers are encouraged to address matters concerning air traffic control to:

Director
USAATCA Aeronautical Services Office
Cameron Station
Alexandria, VA 22314

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ANNUAL WRIT - 1981

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THE 14-MONTH LIFE of the 1981 Army Aviation Anual Written Examination (AAAWE) began last month. By next December each aviator in an operational flying position will have taken the "Writ."

As the written component of the Annual Aviator Proficiency and Readiness Test (AAPART), successful completion of the examination is required during the 90-day period preceding the last day of your birth month. Army Regulation (AR) 95-1 specifies procedures for both taking the examination and for failures.

The examination consists of 50 multiple-choice questions designed to evaluate your knowledge in all aspects of planning and tactics for a variety of flights related to your mission.

The Writ is not just one exam, but 24 different exams—four versions for each aircraft type that has an aircrew training manual (ATM). They are:

- Observation Helicopter (OH-58, OH-6)
- Utility Helicopter (UH-1, UH-60)
- Attack Helicopter (AH-1)
- Cargo Helicopter (CH-47, CH-54)
- Surveillance Airplane (OV-1)
- Utility Airplane (U-21)

Of the four versions in each ATM category, two are written with Federal Aviation Administration (FAA) instrument/regulation questions and two are written to International Civil Aviation Organization (ICAO) flight rules for aviators operating in Europe. Your unit test control officer (TCO) will administer only FAA or ICAO versions, based on your unit's location.

The process of keying examinations to the ATMs began in 1977 and is being continually refined. Each exam is oriented to the tasks and combat mission in the respective ATM, allowing questions to be directed to your mission and aircraft and helping to avoid irrelevant and general-nature questions. The Writ has evolved from a test of instrument flight procedures to overall mission requirements. In 1970, 85 percent of the exam consisted of instrument procedures/flight regulations. In 1975, this subject area comprised about 50 percent of the exam. The 1981 exam for attack helicopters contains only 10 such questions. The matrix at right shows the distribution of questions in subject areas in each ATM category.

The principal components of the exam are the exam booklet, reference data booklets (RDBs) and the exam notice. The exam booklet contains instructions, the exam questions, performance and weight and balance charts and, in some versions, weather forecasts/notices to airmen (NOTAMs) for instrument flight questions. To keep the exam challenging yet reduce RDB research time, questions have been grouped. Groups of questions often begin with a note which includes the title of the reference manual. Within that group, questions are taken sequentially from the reference. If the note states that the questions pertain to rotary wing flight, turn to Field Manual (FM) 1-51 in RDB Volume II. If the answer to the first question in that group is found on page 2-31, the next question will be found on or after that page.

RDB Volume II contains indexed extracts of field manuals, training circulars, regulations and other appropriate publications. Change 2 has been issued for this RDB, including additions of FM 1-51, portions of the newly published FM 1-50, several pages of the Airmen's Information Manual, FAA abbreviations and interim changes to AR 95-1.

RDB Volume I contains extracts of flight information publications (FLIP) for FAA exam versions and is unchanged. RDB Volume III, which contained ICAO FLIP, has been deleted. U.S. Army, Europe (USAREUR) aviators will use their current FLIP for instrument flight/local area questions developed by the USAREUR Standardization Board.

The exam notice should be issued by your TCO. It describes the exam, lists references and gives hints for preparing for and taking the exam. The TCO will also issue AR 95-1 and FM 1-88. You may bring your dead-reckoning computer and an electronic calculator. An operator's manual for the appropriate aircraft is desirable, since most performance charts reproduced in the exam are without instructions or explanation for their use.

To assist you in preparing for the exam and to familiarize yourself with the organization of the RDBs, you may request last year's (1980) materials for study purposes 2 weeks prior to your 1981 test.

The examination is a good evaluation tool and TCOs should analyze local exam results and provide information, as desired, to commanders. If an aviator missed several questions in one subject area (instruments, threat, weight and balance, etc.), further training may be indicated. If several aviators show a particular subject weakness, further unit training may be needed. Commanders should be innovative in using test results to improve individual and unit proficiency.

As ATMs are published in final form, the Writ will be more closely tied to ATM tasks and standards.

Every effort has been made to produce a relevant and correct examination through validation and the aid of subject matter experts. You will find the 1981 Writ to be both challenging and informative. Good luck!

1981 AAAWE
QUESTION/SUBJECT AREA DISTRIBUTION,

	UH/CH	AH/OH	SA	UA
Flight regulations, FAA/ ICAO instrument procedures	15	10	15	20
Tactical instrument	4	4		
Performance, weight and balance	6	6	6	6
Tactical employment, threat	12	17	19	14
Flight, aerodynamics	6	6	5	5
Extreme conditions: hot, cold, mountain; medical	7	7	5	5

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Advanced Cross-Track Orientation
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Corridor Orientation I, Pt 2
Corridor Orientation II
Corridor Orientation III

FLIGHT OPERATIONS COORDINATION

Interpreting Aeronautical Sectional Charts
Hourly Weather Sequence Reports, Pt 1
Hourly Weather Sequence Reports, Pt 2
Hourly Weather Sequence Reports, Pt 3
Hourly Weather Sequence Reports, Pt 4
Hourly Weather Sequence Reports, Pt 5
METAR, Pt 1
METAR, Pt 2
Terminal Weather Forecasts

AIR TRAFFIC CONTROLLER

Control Information Symbols, Pt 1
Control Information Symbols, Pt 2
Clearance Abbreviations
Miscellaneous Abbreviations
Numbers Useage
Priority Identification
Aircraft Identification, Pt 2
Radio & Telephone Usage

HELICOPTER MAINTENANCE UH-1

Intmed Insp Guide—Tailboom Area, Pwr-On Checks
PMS Inspection Lubrication
Turbine Engine Analysis Check
Adjust Bleed Band UH-1H
Opn Check Bleed Band Adjustments
Remove Overspeed Governor, UH-1H
Install Overspeed Governor, UH-1H
Opr Chk, Variable Inlet Guide, Begin To Open Pos
Opr Chk, Variable Inlet Guide, Full Open Pos
Remove Fuel Control Unit, UH-1H
Install Fuel Control Unit, UH-1H
Prime Fuel Control Unit, UH-1H

HELICOPTER MAINTENANCE OH-58

Intro To PMI Inspection
Daily Inspect Guide To Intr Flsg, Cabin & Land Gear
Daily Inspect Guide To Tailboom, Avionic, Intr Fslg
Dly Insp Guide-Pylon, Land Gear, Cabin, Nose, Pwr-On
Remove And Inspect A Hydraulic Servo Actuator
Install A Hydraulic Servo Actuator
Disconnect, Remove Transmission & Mounting
Clean/Insp/Install Transmission & Mounting
Rmv, Exch, Install Mag Brake, Force Gradiant
Operational Check, Force Train System
Remove Air Frame Fuel Sys Components
Inspect Air Frame Fuel Sys Components
Install Air Frame Sys Components
Leak & Functionally Check Air Frame Fuel Sys